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Including Space Technology

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August 25, 1958

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AVIATION CALENDAR

- Sept. 17-19:1958 Portsmouth Flight Display and Exhibition Society of Dutch Aviation Convention, Portsmouth, Eng.
- Sept. 19-1958 Cryogenic Engineering Conference, Massachusetts Institute of Technology, Cambridge, Mass.
- Sept. 14-16:1958 Summer Piggy Meeting, Cambridge University, Cambridge, Eng.
- Sept. 14-15:1958 International Congress of the Astronomical Sciences, Plaza Hotel, Madrid, Spain.
- Sept. 9-11:1958 Second National Conference on Applied Meteorology, Engineering, and Astronautics, Mach. Program, Chicago, Ill.
- Sept. 10-11:1958 1958 Top Engineering Bldg., University of Michigan, Ann Arbor, Mich.
- Sept. 11-12:1958 Annual Eastern Meeting and Conference, Northeast Chapter, American Assoc. of Applied Mechanics, Minneapolis, Minn.
- Sept. 12-14:1958 Fall Meeting, American Rocket Society, Inc., Hotel Statler, Detroit.
- Sept. 17-19:1958 National Instrumentation Conference, 8 E. 42nd St., New York, N.Y.
- Sept. 17-19:1958 Symposium on the Statistical Theory of Systems, Philadelphia Convention Hall, Philadelphia, Pa.
- Sept. 17-19:1958 Convention of the National Bureau of Standards, Schuylkill County Hotel, Philadelphia, Pa.
- Sept. 22-24:1958 Meeting, Professional Council on Tobacco and Cigarettes, Central American Hotel, 3rd Floor, Miami Beach, Fla.
- Sept. 21-25:1958 Seventh Annual Meeting, Speeches, Engineers Society, Engineers Franklin Hotel, Philadelphia, Pa.
- Sept. 21-25:1958 Annual National Western Forum, American Helicopter Society, Ambassador Hotel, New York City.
- Sept. 25-26:1958 Air Force Ann. Annual Convention and Aerospace Personnel Talks.

(Continued on page 6)

AVIATION WEEK including Space Technology
August 25, 1958
Vol. 45, No. 8

Discover more with an additional issue to *Aviation Week*. This special issue, *Space Technology*, is a must for anyone interested in the latest developments in space exploration. It includes articles on the latest in rocket propulsion, satellite technology, and the challenges of space travel. This issue is available for purchase separately or as part of a subscription to *Aviation Week*.

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Precision Transducers

AVIATION CALENDAR

(Continued from page 5)

- Sept. 28-Oct. 1-114th Meeting, Electrochemical Society, Chateau Lacombe, Ortonville, Canada.
- Sept. 29-Oct. 3-National Aeronautical Meeting Society of Automotive Engineers, Inc., the Automobiles, Los Angeles.
- Sept. 29-Oct. 3-National Aeronautical Meeting and Western Test Show, American Society of Test Engineers, Sheraton Exposition Hall, Los Angeles, Calif.
- Oct. 1-2-Conference on Radio Interference Reduction sponsored by American Research Foundation and U. S. Army Signal Engineering Laboratory, Vinton of Science and Industry, Chicago, Ill.
- Oct. 1-3-National Airports Conference, University of Oklahoma, Norman, Okla. Cosponsored by American Assoc. of Airport Engineers and the FAA.
- Oct. 4-American Aerial Acrobats, Banquet, Society of Experimental Test Pilots, Beverly Hilton Hotel, Beverly Hills, Calif.
- Oct. 6-7-National Symposium on Forward Range and Space Transportation sponsored by Institute of Radio Engineers and George Washington University, Lower Annapolis, Washington, D. C.
- Oct. 7th-1958 Joint Meeting, Institute of the Aeronautical Sciences and Canadian Aeronautical Institute, Chateau Lacombe, Ortonville, Canada.
- Oct. 7-13-Sixth International Communications Conference, Geneva, Italy.
- Oct. 8-10-14th Annual North-South Flight and Inertia Conference, Champion Spark Plug Co., Silver Hill, Toledo.
- Oct. 9-10-Ninth Annual National Name Abstracting Symposium sponsored by American Abstracts Foundation, Sheraton Hotel, Chicago, Ill.
- Oct. 10-11-12th ASEE Joint Exhibition Conference, Sheraton Hotel, Los Angeles, Calif.
- Oct. 10-15-1958 Annual National Flight Range Conference, Ford Stadium, Chicago, Ill.
- Oct. 15-17-Twelfth Annual Meeting, Southeastern Airport Managers Assn., The Pines Beach, Yonkers, Pines Beach.
- Oct. 18-22-1958 Annual Meeting Assn. of the United States Arms, Sheraton Park Hotel, Washington, D. C.
- Oct. 21-24-1958 National Standalone Conference sponsored by Institute of Radio Engineers, Professional Group on Electronic Computers, Sheraton Hotel, Dallas, Tex.
- Oct. 25-14th Annual General Meeting of the International Air Transport Assn., New Delhi, India.
- Oct. 27-31-East Coast Conference on Astronautical & Navigational Electronics in State of Radio Engineers, Lord Nelson Hotel, Baltimore, Md.
- Oct. 30-31-1958 Electron Device Meeting sponsored by Institute of Radio Engineers, Sheraton Hotel, Washington, D. C.
- Nov. 30-12-International Conference, Physics and Mechanics of the Atmosphere and Space sponsored by the Bureau of Aeronautics, San Antonio, Tex.



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man-hours
at Convair

Says Helen Carter,
Convair's "A", Materials
and Processes,
Engineering Department,
Convair, Ft. Worth



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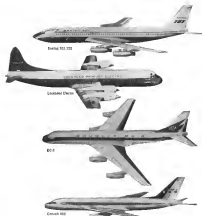
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WHO'S WHERE

In the Front Office

G. A. Billings, vice president finance and treasurer and H. B. Baker, vice president operations, Room Equipment Co., San Diego, Calif. Vice B. K. Goodwin, secretary, and M. K. Smith, financial director.
D. W. R. G. Baker, president of American University Research Corp., a division of General Electric Co., San Francisco, Calif.
J. C. Mabe, a director, Chicago Press, Inc., New York, N. Y. Vice president of operations.
Frank H. Edson, president, U. S. Industries, Kell Technical Center, Inc., Pomona, Calif.

Donald J. Hagan, vice president, Atlantic Research Corp., Alexandria, Va. Mr. Hagan continues in charge of operations.
Robert E. Hagan, vice president, Pacific Research, Inc., La Jolla, Calif.
Robert S. Levin, vice president, Pacific Research, Inc., San Ysidro, Calif.
Donald J. Hagan, vice president, engineering, and George F. Hagan, vice president, West Coast operations, Kell Technical Center, Inc., San Ysidro, Calif.
Donald J. Hagan, vice president, engineering, and George F. Hagan, vice president, West Coast operations, Kell Technical Center, Inc., San Ysidro, Calif.

Walt Schindler, vice president, engineering, and George F. Hagan, vice president, West Coast operations, Kell Technical Center, Inc., San Ysidro, Calif.
Larry S. Wainwright, vice president, Ohio Aero Design & Engineering Co., Dayton, Ohio.
Robert S. Levin, vice president, Pacific Research, Inc., San Ysidro, Calif.
Donald J. Hagan, vice president, engineering, and George F. Hagan, vice president, West Coast operations, Kell Technical Center, Inc., San Ysidro, Calif.

Cap. Edward W. Baker, (USA) has been assigned to the North Atlantic Division, Air Force Research Development, U.S. Air Force, Dayton, Ohio.
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Honors and Elections

Dr. Anthony J. Capocci, the head of Goodrich Aircraft Research & Development Corp., has been elected to the U.S. Air Force Research Committee on Air Science of the National Academy of Sciences, Washington, D. C.

Dr. Walter P. Dyer, director of Lockheed Research Institute, has been elected to the U.S. Air Force Research Committee on Air Science of the National Academy of Sciences, Washington, D. C.

Robert L. Dyer, administrator, vice president and controller of Walter Kidde & Company, Inc., has been elected president of the National Association of Manufacturers, Inc., a division of the National Association of Manufacturers, Inc., a division of the National Association of Manufacturers, Inc.

(Continued on page 51)

INDUSTRY OBSERVER

Three radar look between Washington and Port Harbor, Hawaii, will be provided by Navy's new missile, communications system now being installed. Navy expects to achieve a range of about 5,000 mi. in using more as a passive radar. System will provide one voice channel in several multiple channels (AW No. 12, p. 12). It will replace 54-ft. diameter antenna used in 1955. Kinds of Co. which will be similar to those employed for radio intercept.

Dr. James will soon call for industry help in development of a bomber launched medium-range ballistic missile. Countries selected to bid reportedly include Bell Aircraft, General Electric, Martin and North American. Bell and General Electric may have a joint team proposal.

Graphic technology, records from launch to splash now obtained, as the most recent in the last two years. That this group, Record of Technology in that group includes acceleration, shock, tests to one thousandth of a second, showing that the same trend in a living acceleration. Most were accidental to some purpose of the Air Force—last vehicle electrical and some case experiment—but provided useful information, even though they were not accurate from the sea. USAF and Navy developed interests in these findings on the way.

Static testing of Titan engines at Cape Canaveral, Fla., will be done in sequence to simulate under high of second engine. Larger first stage is placed in test of two full-down games. Immediately next is it in second stage in another full-down game. Stages are electronically connected so that second engine fires after first stage has fired and simulated counting from the stage. Blockhouse also is involved, unlike the single-stage Atlas blockhouse.

Number of reorganization changes are in the way for General Electric's Defense Electronics Division. Most significant will be the formation of a weapon system management department to reduce GE's ability to get together weapon system contracts and to better integrate efforts of individual departments. Responsibilities for space vehicles will be assigned to Missile & Guidance System Department, primarily building some cases for Atlas and Titan ballistic missiles.

Navy is evaluating the Sea Sparrow missile helicopter for possible use off destroyers as an anti-submarine missile weapon. Navy currently hopes to extend concept of using small helicopters off destroyers to equip-ment replacement of patrol anti-air vehicles for both bombing and killing submarines. Destroyer may extend a destroyer's present ASW capability by hundreds of square miles. Airplane is being built in U.S. Navy base in Republic Airplane Corp.

Combiner system for production models of Navy's Polaris fleet ballistic missile is expected to weigh as much as 10,000 lbs. in weight. Designers for the missile development had been under contract since the missile's development. Polaris' guidance is being developed by Massachusetts Institute of Technology and General Electric.

Polish test vehicle is dynamically suitable to provide extreme test of effectiveness of X-15 thrust vectoring wings. CF 12 wings to test, 16 in. and to be completely successful, five partially successful and one unsuccessful.

'Self' gasless reportedly is in advanced stage of development and is the first in the history of the Navy's Air Force of Sciences. Liquid gasless is mixed with plastic, which is then a thick paste of 90% gasless, which is shaped into bricks. Bricks are shipped in a special tin to prevent explosion. The purpose of the self-form of gasless is to improve its heat resistance qualities and reduce the possibility of explosion. Liquid gasless may be obtained from the bricks is subjecting them to pressure.

THE PLASMA JET—

a case of
research and
advanced
development

Development of a re-entry stabilization facility for the Air Force 7400 KC-33D now once required a method for heating air to extremely high temperatures. A special type of electrical discharge, sometimes called a "plasma jet," was considered. Both fundamental research—to obtain a quantitative understanding of the arc properties and mechanisms—and applied research in actual aerodynamic and materials testing were needed. Advanced development—the actual design and construction of improved test facilities—was also an inherent part of the problem.

Theoretical and experimental physicists, aerodynamicists and physical chemists began a simultaneous attack on the fundamental problem. At the same time, and in close association with the others, instrumentation and mechanical engineers began to build and use a series of continuously improved facilities for re-entry testing. These inclined toward either fundamental or applied research in their particular specialty were able to maximize their integrity and their own research approach. At the same time they were able to benefit from the close working association with one another.

The results were especially fruitful. The plasma jet has proven an excellent tool for re-entry studies. Investigations of important applications in high-temperature chemistry, space propulsion and restructures are following in an added bonus.

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Research & Advanced Development



Washington Roundup

Procurement Studies

House and Senate Armed Services Committees and Defense Department will make comprehensive studies of the military procurement system to pave the way for action on legislation early next year when the new Congress convenes. Moves in this direction include:

- Sen. Everett Stearns (Main.) high ranking legislation on Senate Armed Services, asked Committee Chairman Sen. Richard Russell (D-Ga.) to direct the staff to make a research and evaluation study on legislation he recently introduced that would expand use of the "open market" and broaden competitive contracts and distribute authority, supervision of research and development contracts (AW Aug. 18, p. 20). He has asked the Secretary of Defense and the three service secretaries to have their study do the same. Stearns plans to make recommendations study as a result of those studies and introduce revised legislation in January.
- Staff of the House Armed Services Committee Sub-committee shortly will complete its investigation of military procurement with emphasis on "alliance system" contracting. The group's chairman Rep. Edward Wilentz (D-La.) plans hearings in mid-November. Members of the subcommittee have been antagonistic toward the weapon system and the extensive use of negotiated contract. The group has consistently urged greater use of formal advertised bid contracting.

Defense Funding

Legislation which is its support from threatened to drop up new defense funding conflicts by putting both new contract money and expenditures for paid-on and research and development on a two-year basis was introduced in the House by Sen. James Buckley (R-N.Y.) in the House. It is expected to have little if any effect. As yet in the White House the measure passes.

- That full funding, as at present, shall be continued for military production and research and development. In the capital version, long-term plans would have to be revised, general financing year by year from annual congressional appropriations.
- That the President may recommend and the Congress set an annual ceiling on Defense Department spending. The ceiling in general. Under the original version, for firm orders, established in law, would have been imposed. Members of House Appropriations Committee emphasized the impossibility of establishing a realistic ceiling a year in advance.

CRAF Negotiations

Air Force Secretary James H. Douglas met with one special military officials last week in a move to reach an agreement on the proposed strategic contracts covering the Civil Reserve Air Fleet (CRAF). No discussion on the terms of the contracts were made during the Pentagon meeting but both Air Force and the airlines agreed to resume negotiations on Aug. 26.

Until this meeting, little or no action had been taken on the proposed contracts during the past three years although the airlines have been prepared to begin the fleet to the Defense Department in the event of an emergency without the benefit of awards. Last week Stuart C. Towner, president of the Air Transport Assn. charged that the Air Force had failed to act on

the standby contracts despite the fact the airlines have consistently shown a desire to work the issue.

Meanwhile, the ATA reported that some 70 million passenger miles of traffic were offered the military by the U.S. scheduled airlines in response to an Air Force request following the Mid East crisis last month. ATA said that enough air service to its more than 11,000 personnel in Lebanon was offered the Air Force and that the traffic could have been played into operations immediately without interrupting regular civilian service.

Defense Committee Cut

Defense Department on Sept. 1 will schedule another 75 of its coordinating committees cutting the number from an original 199 to 124. Defense already had eliminated 133 committees (AW Feb. 7, p. 35) and deleted others from the list by ruling that they were not needed to be Joint Department of Defense committees.

The cuts were made on orders of Defense Secretary Neil H. McMillan in an effort to accelerate the decision-making process within the department. Next step will be to review Defense Department representation of other Departmental and interdepartmental committees.

Renegotiation Outlook

Congress last week indicated its intent to extend the renegotiation law by an another 10 Dec. 31. The House and the Senate Finance Committee voted the six month extension. They also extended the law to include contracts let by the U.S. National Aeronautics and Space Administration. The White House had wanted a two-year extension of the act.

W. M. Allen, president of Boeing Airplane Co., speaking for Aircraft Industries Assn., led the opposition to the law in testimony before House Appropriations Committee (AW Aug. 18, p. 37). Robert Davidson, general counsel of Defense Department, presented the Administration's support for the measure.

Post-Contract Analysis

Air Force is getting "lessons taught" toward establishing criteria for a post-contract analysis of profits to determine how well a company accomplished "what they agreed to at the outset" according to Lt. Gen. C. S. Irvine, deputy chief of staff for military. The analysis would include an evaluation of management and bid cost, performance and be used in establishing a firm's eligibility for incentive profits. Gen. Irvine says it might also be used in subsequent review of the contract by other authorities, including the Renegotiation Board.

Controller Hesitancy

Civil Aeronautics Administration is becoming concerned over the continuing loss of its best air traffic controller talent to airlines. FAA responsibility. While CAA has avoided public expression of this concern, spokesmen say that many of the best qualified students have refused promotion from assistant to chief controller when it was offered because of the added work load and responsibility. Civil Service Commission, they say, this emphasizes the problem of filling top controller jobs, since the assistant controller can elect to remain at the lowest grade while making other arrangements.

—Washington Staff

Recruiting Pace Rises, Wescon Indicates

Search for engineer services centers on high degree of capability rather than former "stockpiling" practice.

By James A. Pires

Los Angeles—Engineers at the Westcon Electronic Show and Convention here are discovering that the intense competition for their skills between companies throughout the aerospace and electronics fields is back on track, better perhaps than the highest levels of two years ago.

Competition is not the search for worn bodies of past years for stockpile purposes. "No companies are looking for a capability," Raftery, it shows marked emphasis on a high level of ability. One of the more important effects of the past year's business upturns has been to give companies a greater increased consciousness of the need for quality in engineering personnel.

A survey of representative companies in the industry made by Antonette Weiss indicates that several departments are not making major modifications in their offensive and defensive tactics over the coming year. Trends affecting recruiting are:

Average engineer is in the aerospace and electronics fields, six years out of school, today is earning \$10,000 per year. The above average engineer is earning about \$12,000 and the below average engineer about \$8,000. Demand for aerospace engineers never decreased, nor were his jobs in domestic program curtailed as was claimed earlier.

The supply of average engineers appears to be dropping as fairly rapidly. Many quality engineers are finding it increasingly difficult to migrate from one job to another as in the past.

ARDC Static Stand

Weight Patterns AFIR. Other to Research and Development. General reported last week that construction of the world's largest and quietest static test stand for turboprop engines has been completed at Wright Air Development Center. Now stand is designed to test 60,000 lb. thrust engines and to more 3.5 million cubic feet of air per minute.

Specifications call for the water level inside the test stand to be only 1/16th of an inch above the stand, for mobile and column for the installation use of 45 ft. wide and 50 ft. high. It will be used for testing turbo and turbofans as well as jet engine development and evaluation. Construction of the stand was George W. Timmons of Columbus and Dayton, Ohio.

Engineering assignment is making an increasing effort to keep high potential personnel. To do this, salary policies are being rearranged to provide growth rates larger in some cases by a factor of three than for salaries paid to inferior engineers.

The first of "selecting" salary policies—where a related engineer must be offered a significant salary increase and then be attempted to reassign—appears almost to be. Also, more attempts are being made to place their emphasis in the type of projects they must enjoy. These policies are giving off an isolated flavor of law personnel.

Most mobile people in the present labor market are those willing to change jobs, are the younger engineers who have been out of school for several years and are finding their salaries adjusted between the early sixties at which their salaries rose and the steady increasing starting salaries being paid more recent graduates. Company managements are thus exerting high attention at this level in the price of maintaining acceptable wage scales.

Unanswered Questions

One of the unanswered questions of the present recruiting situation is about the large numbers of senior aerospace engineers who will come from business in engineering still desired by companies something like average 20% over the next few months. The situation, in the opinion of some executives, is already in worse shape than it ever before because the group with high qualifications being recruited is not smaller than the engineering pool that has long recruited two years ago.

Among the questions asked recently and company officials said the answers given were the following:

When asked if this company's recruiting efforts had been stepped up during the last six months, 90% said "yes." The remaining 10% said that the level of effort is about the same, that it had never slowed down.

Asked if the available supply of engineers had tightened up during this period, more than 10% said "yes" while the remaining companies explained that they were being more particular in selecting specialists who were definitely in short supply.

Electronic and aircraft engineers are not scarce, especially those high level engineers with broad backgrounds in research and development. Companies seeking engineers for work on guidance

systems, computers, instrumentation and structures and they are having difficulty. Physicists, and others with training in the fundamental sciences, are hard to find.

All companies indicated that they have not lowered their hiring standards either as to experience or quality as a means of acquiring additional engineers. About 10% said that after their lowering their standards, they had raised them and were seeking higher quality personnel.

When asked if salary offers had been raised over the six months period, companies divided about equally. Some saying absolutely not and the other answering with a qualified yes. Qualifications ranged from saying that the trend was definitely upward to say companies that stated it would pay whatever additional income was necessary to obtain the help it needed. The average increase was 5%.

In discussing the number of engineers that they would like to hire over the next six months, most of the largest companies named figures beginning at 100 to a high of 1,500 of which approximately 50% would be aircraft or electronic engineers.

Most executives wanted experienced engineers, although one or two smaller companies said that they would hire junior engineers for on the job training.

The increase in engineering staff represented by these figures is not 20%. Smaller companies felt that the group from 10% to 20% while, with the variable increase the larger companies planned increases from 20% to as high as 40%. In the case of the larger companies, the figures obtained were for the specific divisions working in the fields of electronics, aviation, missiles and ground support equipment.

Opinions differed widely on whether the industry's own companies had suffered economic attrition due to competitive recruiting during the last six months. While no two answers were exactly the same, they ranged from a hopeful "no" to a somewhat qualified "yes." Some noted that recruitment efforts now limited to the electronics and aviation segments.

Packaged Liquid Order

Boeing, N-1—New has placed five orders for peroxidized liquid, peroxidized rocket engines with Reaction Motors Division of Thielert Chemical Corp. Order is for thousands of Reaction Motors' Catalytic engines for the N-1 missile, to be in Space III missile.



Russian Contrast: Trucks Tow MiG-17s

Sharp contrast in Russian concept of an air modernization is illustrated there in case of Red Air Force jet has jet lights, the MiG-17s are towed down a runway by World War II trucks. Note nose riding on truck beds, probably to aid in low gear takeoff.

Space Technology

NASA Budget Cut \$45 Million By Conferees of House-Senate

Washington—House-Senate conferees last week voted a \$45 million cut in the first year budget for the new National Aeronautics and Space Administration—before the permanent bill on Capitol Hill for a billion space program.

NASA asked for \$125 million. The conferees agreed to \$80 million, and the House concurred.

Meanwhile, the Senate unanimously confirmed the nomination of V. Keith Gleason as NASA administrator and Hugh L. Dryden, its deputy administrator (AW Aug. 16, p. 25).

Personnel in the conferees action: the

Senate had approved the full \$125 million asked by NASA, supporting this on the Senate floor. Sen. Lyndon Johnson (D-Tex.) supports leader and chairman of the Senate's Special Space and Astronautics Committee said.

The \$125 million appropriation request which was a very modest one, and, we thought considerably less than it should have been given only after careful planning and programming under the direction of the President (AW Aug. 12 p. 13).

The program has been laid out in detail and represents an integrated and

balanced approach to the agency's astronomical responsibilities.

Here's how the conferees' cut was distributed:

- Salaries and expenses, \$2 million. The conferees approved \$5 million of the \$7 million asked.
- Research and development, \$20.01 million. They approved \$18 million of the \$38.2 million asked.
- Construction and equipment, \$27.8 million. The conferees approved \$25 million of the \$57.8 million asked.

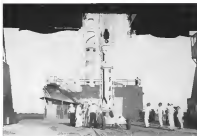
In addition to its direct appropriation, NASA will have \$215 million for its first year. Financing \$117 million in funds transferred from Department of Defense and \$100 million approved for National Aeronautics and Space Administration, professor of NASA. Defense Department has estimated \$234 million for the space activities of Advanced Research Projects Agency.



Doppler-Inertial System Navigates Convair B-58

Doppler inertial navigation system for Convair B-58 Hustler automatically navigates bomber and controls altitude of its 35th, fourth and fifth sets of AN/VG-10 about 0.5 ft. at any given speed indicates new Space-developed system is 10 times as accurate as present operational system, company says. Use of inertial navigation instead of navigation aids enables B-58 to approach target without revealing its presence to enemy reconnaissance systems. Doppler inertial system is used to control its inertial component errors until bomber approaches enemy targets. Ground-based platform for B-58 shown under test in 1951 also provides backup to other navigation equipment on board. Space says B-58 system weighs 2000 lbs. (occupies 5770 lbs. less volume than present system).





TECHNICIANS erect modified Vanguard second stage prior to mating it with first stage. Their laborer for first hour probe shot. At left, complete vehicle from launch pad.

First U.S. Lunar Probe Fails

By Evett Clark

Cape Canaveral, Fla.—First U.S. lunar probe test vehicle had executed a 55-hour orbit and then was seen performing perfectly last week until an apparently random failure caused an explosion that ripped apart the Thor first stage engine after 77 sec. of flight.

Despite the early failure, engineers on the project took some satisfaction from these points:

- Difficult task of launching a liquid-fueled rocket precisely at a time set some weeks earlier was almost achieved.
- Target time was 7:14 EST Aug. 17. Launch time was 7:18 EST, and the four seconds delay was caused by radio interference from a source outside the Air Force Missile Test Center.
- Roll (yaw) motion into the right and successfully executed was of greater magnitude than any so far as a Thor-Able shot. Telemetry data indicated that the control system, in which some changes had been made since the last previous flight, worked well.

• Telemetry records confirm that the flight was going perfectly until the explosion. Maj. Gen. Bernard A. Schriever, commander of Air Research and Development Command's Ballistic Missile Division, said immediately after the flight "everything was perfect up to this particular point."

USAF plans to attempt a second lunar probe launching in the low-day period beginning Sept. 16. Thor first

stage already is at Cape Canaveral. Fuel tank of the Pioneer satellite that would stream an orbiting orbiter around the moon probably will be the stage as that used in the first try.

Explosion occurred at approximately 50,000 ft. and approximately 10 mi. at an exactly 77 sec. after launch, or 70 sec. short of moment of Thor's Rocketdome engine. Suspected cause of failure was a ruptured JP fuel or liquid oxygen line.

By last last week only pieces of wreckage and skin had been recovered by divers. Upper stages were being examined last week together. Radio telemetry signals from upper stages and payload were received for approximately 121 sec. after the explosion and upper stages were tracked all the way to impact with the ocean.

The Rocketdome engine, first of the production line at the Nacabo, Mo., plant, was not static tested at Cape Canaveral. Neither were the first stage engines in the last two of the three Thor-Able shots that preceded the lunar vehicle. Lunar vehicle was designated Able 1.

Schriever said a ruptured fuel or liquid oxygen line would be considered a serious failure that could not have been predicted. Static testing might not have produced the same failure that the stresses of actual flight did and also might have caused other damage. Rocketdome problems and Thor-Able shot also will use a Nacabo engine.



VANGUARD second stage joining Aerojet-General liquid-propellant engine is mated with Thor primary stage at left. Second and third stages are joined at right.



After Promising Launch

The 55-ton Able 1 was launched at an angle of approximately 321 deg. north of the equator, the most southerly angle for any being along the Atlantic Missile Range except for the recent launching of Explorer IV at 51 deg.

Even the achievement of free flight was considered unlikely. Douglas Thor met in the first stage, has had 14 test flights out of 15 launches. Schriever said the engine was in burning condition of the last seven launches, which included the three Thor-Able shots.

The 7,100-lb thrust Aerojet-General

second stage engine has been fired in flight four times in the Vanguard satellite vehicles and has been used in the second stage in the three Thor-Able 1s at least two of the Thor-Able 1s performed perfectly.

In the Vanguard, the Aerojet engine is controlled by Navy, with three successful firings out of four tries. On one shot it performed successfully. On another, it had the same but two electrical cables failed, and the third stage was not ignited to fire. On another, cutoff came too late, putting the vehicle at too high an apogee angle for an orbit. On this fourth, the engine cut off prematurely, and terminated the flight.

Schriever said the control system for this stage has been "changed very considerably" from the Vanguard configuration.

Allegany Ballistic Laboratory's 2,000-lb. boost third stage engine for Able 11 never has been fired in flight but has been static tested at Arnold Engineering Development Center. Fourth stage engines, a 1,500-lb. thrust rocket surrounded by the model payload unit and pointed upward at the time of launch, is a Thorol engine similar to those in the Falcon satellite.

If the vehicle had performed satisfactorily, both the second stage and right spin rockets were to be jettisoned shortly after separation of the first stage. After the second stage burned and separated, an accelerometer firing controlling the third stage payload was to stop.



RETROCKET is visible in top of upward-outward package. Flight versus control for forward velocity and vector control are attached at the base. Instruments visible under rocket TV camera.



THOR-Able rocket exploded shortly after the lunar launch at Cape Canaveral. Vertical streaks and white dots are pieces of metal being seen from the explosion.

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Ramo-Wooldridge to Sever Ties With Space Technology Division

Los Angeles—Ramo-Wooldridge Corp. has moved to sever all operational and financial ties with its former Space Technology Laboratories division with the announcement that Gen. James H. Doolittle will become Board Chairman of the latter on Jan. 1 and that all Ramo-Wooldridge representation on the board of directors will be withdrawn shortly thereafter.

However, Ramo-Wooldridge and Thompson Products, with which it plans to merge (AVP Feb. p. 28) retain full ownership of Space Technology Laboratories and have no plans to dispose of those holdings, an official told Aviation Week.

Space Technology Laboratories serves as technical consultant to Air Force on ballistic, attack, program and research space technology projects, including the lunar probe program.

Dr. Steven Dym, president of Space Technology Laboratories, will return to his former post as executive vice president of Ramo-Wooldridge after a short transition period. He will be succeeded as president by Dr. Leon Dren, currently executive vice president and general manager of Space Technology Laboratories. Richard Mottin will succeed Dym as executive vice president

of Space Technology Laboratories. Plans to establish Space Technology Laboratories as a completely separate system stems in part from a mutual desire on the part of the Air Force and Ramo-Wooldridge to divorce SLL's technical management clients from Ramo-Wooldridge's own activities in the astronautics field. Under the original terms of the Air Force contract, Ramo-Wooldridge was excluded from participating in a study to determine the status of the USAF ballistic missile program on which it was serving as a technical adviser.

The latest move follows earlier partial steps which saw Space Technology Laboratories established first as a separate division, later as a separate corporation, but with Ramo-Wooldridge representation on its board of directors. Under the new arrangement, Ramo-Wooldridge and Thompson Products will receive one financial unit on SLL operations as the sole stockholder but will not have access to non-financial data, a Ramo-Wooldridge official says.

As a separate corporation, Space Technology Laboratories will have total assets of around \$23 million, net assets of about \$17 million. Annual revenue of

about \$40 million will equal \$40 million.

Contractors will employ a total of 2,500, including approximately 800 engineers and scientists. This will leave Ramo-Wooldridge with total employment of around 1,500, including approximately 600 engineers and scientists.

Space Technology Laboratories will not be operated as a new profit organization. A Ramo-Wooldridge official says it will be expected to show a modest return on its own investments.

Gen. Doolittle will retain as vice president of Shell Oil Co. before assuming new duties, but will remain on the Shell board of directors.

House Group Criticizes USAF, Navy Buying

Washington—Air Force and Navy were criticized for not having set adequate criteria of inter-related rocket launchers and for differing perceptions in a report released last week by the House Government Operations Committee.

Later, Congressmen in the Senate, Calif., from which manufactured the interrelated launchers for both services, went out of business.

Because the Air Force still has no production from its contract for the 1960s and the Navy only a limited quantity, the committee declared there is an "imbalance" between rockets and launchers.

Were an emergency to arise," it added, "the total launch capabilities of Air Force and Navy in-

crease would be substantially reduced by the lack of launchers. USAF's own rockets, the committee said, are being used "for proficiency training with dummy loads." USAF's contract for the 1960s launchers is with General Dynamics Corp., St. Louis, Mo., Navy's with the Bechtel Co., Glendale, Calif.

The committee contended that "the Air Force could have hedged against the risk of an extended waiting period for the new 1960s launchers by quickly supplementing its inventory of accelerated launchers."

The report, which is based on a two year investigation of the launcher program, said:

"Contractors indicated their study and selling to agencies, greatly production. In several meetings between companies and Air Force representatives, past time, accelerated delivery, data, national supply factors, and other matters were discussed. The Air Force did not follow through on its negotiations and Contractors Industries went out of business."

"In reporting Contractors Industries' plan and strategy to discontinue production of the accelerated launchers, the Air Force left their successors exposed to the risk of an emergency in which the supply of launchers would be severely limited."

Navy's reason for purchasing from the service industry, to the 1960s, in order to achieve "the long-range goal of retroactive compatibility of airborne rocket launchers" was challenged.

"While the program is in progress, it is not clear how the Air Force can be used

interchangeably to assist the 1960s launchers. The committee declared, "other design modifications make the Navy launchers available for the Air Force."

The committee added that "an emergency design device designed in Contractors Industries and costing less than \$5 million has been used to make the same conventional launchers usable on both Navy and Air Force aircraft."

Air Force reduced its requirement for launchers from 47,000 in January, 1967, to 28,767 in March, 1968. Although only a third of the 44,201 launchers the Navy ordered in June 1968, have been delivered, the committee reported that Navy's own work in the last year as the Air Force declared that changing technical requirements make the intended delivery schedule acceptable. This also said that the number of planes using this equipment has been reduced.

De Havilland Designs Dual Spectre Rocket

London—De Havilland Engine Co. Ltd. has developed a double Spectre liquid propellant rocket motor combining a dual thrust Spectre 4 unit mounted above a variable thrust Spectre 5 unit. Development of this engine and a manned rocket engine propulsion system has been proceeding since late last year the engine company disclosed.

As both rocket units have been separately developed over the last five

years, the combination posed no special problems and posed a special category being built a few months after the design was completed.

Both Spectres can be brought into operation up to full thrust and either can be shut down. The variable thrust unit can be fired separately. The arrangement provides a controlled variable thrust range between the full output of the variable unit up to its maximum thrust.

Alternatively, the fixed thrust motor can be operated at its maximum output, combined with one setting of the variable thrust engine.

Combination of two developed units in this way has led to an acceptable powerplant with long life in a much shorter time than would have been involved in designing a composite engine from scratch, de Havilland said.

Upper and lower motor are vertically independent units carried from a common tubular frame and arranged vertically to eliminate the moving moment when operated with a differential thrust.

Alignment of the two units ensures that the thrust lines intersect at the center of gravity of the installation concerned.

Only dependence between the two units is the need to start the variable unit first as this unit controls the pump turbine of the upper engine until the latter reaches its self sustaining speed.

Both rocket engines have hydrogen peroxide as the oxidant with kerosene as fuel.



Northrop Rolls Out Area-Ruled T-38 Supersonic Trainer

Northrop Aircraft, Inc., has rolled out its first USAF T-38 supersonic jet trainer two days ahead of schedule at Hawthorne, Calif. plant. Area-ruled trainers, which will be evaluated by Air Training Command, is powered by two General Electric J65 turbojet engines producing 2,400 lb. thrust each. Air version of T-38 is detachable to permit engine landing gear and removal, each engine has individual track and roller arrangement to facilitate handling. Controls are hydraulically powered. Designers have stressed maneuverability (AVP Jan. 15, p. 11) and safety. Northrop N166F fighters is under parallel development.





General's new Gulfstream turboprop transport has wing span of 75 ft 6 in., length of 64 ft, height of 22 ft 9 in. Only wing panels are built up of integrally reinforced plastic bonded from sheet stock to provide maximum strength and fuel safety.

First Flight Photos of Grumman Gulfstream



Gulfstream is powered by two Rolls-Royce Dart R.D. 702 engines with takeoff rating of 2,165 shp. each. Propellers are four-blade Rotolux. Airplane will carry 30 to 15 passengers at maximum gross of 178,000 lb. Cruising at 15,000 ft. It boasts an exhaust shutoff for dual fuel auxiliary power unit. In case of fire, emergency flight test instrumentation only. Visible antenna on prototype include VOR, navigation receiver and VHF communications ship facilities plus behind cockpit, under the belly (bottom photo) are VHF antennas from antenna used in test program. ADF warning antenna and a listening antenna used in flight tests.



Space Technology

Space Delay Is Blamed on Pentagon

By Russell Hawkes

Felix Allen, Calif.-born, integrated U.S. space programs are being only after 1960 because of the lack of an integrated planning up to the present date, critics to the Western Regional Meeting of the American Astronautical Society here were told by Frank M. Perlman of Convair Astronautics. American efforts in space have been overpriced and overdone to Russian accomplishments in the field, he said.

Perlman made his statements at a guest lecture which opened two days of technical sessions and brought both aerospace and space scientists from most recent technical meetings.

Lack of Familiarity

Perlman said U.S. space projects have been and perhaps may continue to be crippled by the "low degree of familiarity" of Pentagon leaders with the subject of space flight. He called the transfer of decision-making authority from these administrators and political heads to the working level where the problems and possibilities of space flight are best understood.

Part decisions on which programs to support and which to abandon have not also been made on the basis of a good technical understanding of which were likely to be fruitful, he said.

Perlman advocated improved development of various space research, development and test with good education, untrained space vehicles with electric propulsion could be launched within three years and manned vehicles with such advanced propulsion could be in operation in ten years to 15 years.

Selection to many of the problems of electric propulsion may be the question of size with high light reflector reflection to allow good light temperature capability for reducing a large percentage of radiated heat. This would produce a more weight saving. New aerial could be something not done, where but needed for transmission of data with an electric antenna.

El Cal David Sisson of USAF's Aero Medical Field Laboratory, Holloman AFB, N. M., reported to a press conference that Miss High III, next phase of the laboratory's series of extreme altitude balloon experiments, is scheduled for the middle of September. The flight was postponed when Capt. Schick, intended pilot of Miss High III was injured in a training flight. He is recovering well enough to be ready

by the mid-September date. Sisson said that Russian scientists provided very detailed and specific biological data on the dog in the world's first ascent for his satellite up to that time.

He speculated from this that the Russian scientists may not have drawn much information from the experiment.

Weight penalty in space vehicles for excessive structural safety is so high that it may prove more economical to develop ground testing to a far more precise simulation of actual environment than has been done with airplanes. American Astronautical Society members were told by T. C. Harvey of Radiation, Inc. He said the scientific methods of approximating operational loads in ground tests and testing on the aircraft for applications of safety factors was acceptable because additional test needed to carry the extra weight was not prohibitive economically.

This will not be true in space flight, he said. Safety factors are needed where it has not been proven that structure and system components will withstand operational stresses. If ground simulation of the space environment is made a more exact science, the penalty will be reduced weight and improved safety, he contended.

Harvey said that within 10 years, miniaturization and reliability of sensors will reach such a degree that most of the equipment can become disposable and thereby a structural part of the space frame.

Space Metallurgy

Many studies of the field of space metallurgy was recommended. At all levels, low temperatures for metals are undesirable and oxygen atoms or atomic reactions of catalytic, depleters were said. It is likely that materials that contain hydrogen or gas or gas residues which are combined into compounds with the free metals by nuclear radiation. If these free radicals but the system itself, one can be a violent reaction, most of which is exothermic. The heat or the compound bonded of the space dust and ball materials could cause severe erosion. Also serious metals use change their characteristics at the temperatures encountered in space. If it would be wise to study the subject in simulated space environments.

A group of scientists from Lockheed Martin Skunk Works described an experiment they have developed which can measure atmospheric density, and

temperature and angle and true angles of vehicles at satellite altitudes. Described as simple and rugged, the sensor consists of a highly sensitive micro-phase separated film as surface on the forward surface of the vehicle by a mechanical dropper which sheds the entering ambient substance into pulses which are registered by the microphone as an alternating current whose amplitude is proportional to respect pressure or atmospheric density. Satellite speed is independently known. Narrow bandwidth and low noise are obtained by passing the microphone signal in a phase sensitive detector circuit. A signal from the dropper as reference. Current is transmitted.

A house of ambient gas particles spreads as it passes through the surface of the film. The temperature of the components of the molecules. For a given distance between microphones and reflector, spreading will be proportional to the square root of absolute temperature of the gas.

In microphase transition velocity is way the spreading of the beam, the kinetic temperature of the atmosphere can be measured if the satellite's weight of the gas is known. Direction of the beam is determined by the direction of the vehicle's motion. Proper combination of aperture and detector can measure the orientation of the vehicle relative to this direction for an indication of pitch and yaw.

The instrument can measure variation of density continuously with variation of altitude, latitude and local time.

Tracking of satellites yields only average values for the atmosphere density.

Need for more detailed data is shown by rocket measurements at 125 mi. altitude which show variation in density is better than 10 to 15 for different places and times.

Tests indicate that the instrument should function at altitudes of at least 100 mi. with signals to noise ratio of 17 or better.

Lunar Frequencies

Optimization studies at Missile Test Division by Edmund A. Blum indicate the best frequency for earth to moon vehicle communication is about 250 mc., while the most desirable frequency for vehicle to earth communication would be about 100 mc. Difference stems from differing night ionosphere (moon) and availability and predictable atmospheric noise. However, Blum said evaluation of equipment and frequency

AIRLINE OBSERVER

► **President Eisenhower** has been handed a list of eligible candidates for the top post in the Federal Aviation Agency by Presidential Aviation Aide Elwood Quesada. Possibility is strong that Eisenhower will nominate Quesada in the next week in consultation with Civil Aeronautics Administrator James T. McInnis as his deputy. Quesada's chief interest now is to see the agency successfully launched with a competent staff and sensible organization. Once this is achieved, he will act with McInnis, and the administrators that Aviation shows available for the post is Nick Almy, President Delta W. West, former CAA administrator and Civil Aeronautics Board chairman. A number of politicians, including Commerce Undersecretary Louis Fiedorowicz, are reportedly making a bid for the job. The act creating the agency specifically states that the administrator at the time of its creation shall have had "experience in a field directly related to aviation."

► **Delta Air Lines** and the city of Atlanta have entered into an agreement covering the construction of a \$40 million jet overhaul base at the Atlanta airport. Under the terms of the agreement, the city will lease \$5.5 million in special revenue certificates which Delta will amortize at the rate of \$250,000 annually for a period of 25 years.

► **Aeroflot**, Soviet award airline, is publicizing the "superiority" of its service over Sabena's competing position on the new Moscow-Brazil route. Soviet press is emphasizing that Aeroflot's Boeing 740s cover the route in 5 hr. 45 min. as compared with 5 hr. 40 min. for Sabena's DC-7s.

► **Capital Airlines** Macchietto service, called V. L. P. for "very important passengers" as a number of its major routes reached in a 12 month lead time before the start of its service. The airline's also officials are now hoping that the airport will be about an 80% or higher load factor on the special service flights. Program underwent a four-week trial run before it was inaugurated with the company's top-level officials, including President David Heller, flying the trips in critical situations during the shutdown period.

► **The American World Airways** has applied to the Civil Aeronautics Board for permission to suspend its West Coast-Panama route service Sept. 25 and to reduce West Coast London point route service from six flights a week to three. This American contends that the route, which Air France is eager to operate (AW Aug. 11, p. 10), will experience a heavy traffic drop in winter and that jet service this winter will offset what traffic is available to transatlantic routes.

► **Continental China** spokesman on quantity production of the country's first locally produced transport aircraft, the Russian-designed An-2, is well ahead of schedule and that the single-engine 10-passenger biplane will be built this year at a rate 50% higher than originally planned. First Chinese An-2 was manufactured late last year.

► **Airlines of London and Tokyo** Airlines is rapidly developing into the sole representative of the local carrier industry and is doing the heavy hauls caused within the industry last year by the resignation of six carriers from the Conference of Local Service Airlines (AW April 1, 1957; p. 30). Latest carrier to switch from the local service Conference was Midland Airlines and Pacific Air Lines, bringing total membership of the new association up to nine out of 13 local service carriers.

► **Civil Aeronautics Administration** is considering steps to determine the feasibility of operating helicopters under Instrument Flight Rules and on en route. Purpose of the tests is to study procedure measurements necessary to risk fixed wing and rotary wing aircraft in normal instrument traffic.

► **British Overseas Airways Corp.** and Middle East Airlines have reached a profit agreement that permits the sale of the combined services of the two companies on routes between Britain and Middle East.

SHORTLINES

► **Avio Lingua** reports an operating surplus of \$94,000 for the fiscal year 1957-58 ended March 1. During the period, the airline operated 15,941 aircraft flights in Rome and covered 441,363 passengers and 8,514 tons of freight and mail. Total revenue was over \$5,466,000 with total expenses slightly more than \$5,370,000. The figure does not include operations of Airline Firenze (Frank Andrews), which did not begin transatlantic operations until April 30, which was after the closing of the airline's fiscal year.

► **Lockheed** Electric Technology Inc. has passed New York Port Authority its "new pressure" tests. Data obtained by Port Authority by Bell Aircraft and Newman Inc., subsidiary companies, indicates the Electric is quarter 1.47 wt. from start of island than present engines are at a point 2.2 to 3.0 sec.

► **Northwest Airlines** flew 1,064,367,900 domestic revenue passenger miles during the 12 months ending July 31. The new company record is 11% higher than the previous period when the airline flew 953,523,800 domestic passenger miles. Northwest's July passenger miles also increased over last year. The airline flew 189,717,100 domestic passenger miles, a 15.6% increase over July last year, and 11,531,515 domestic passenger miles, a 15.6% increase, for a total July revenue passenger mile figure of 141,233,647.

► **Olympic Airways** of Greece has begun flight on a three-week basis to Frankfurt, Germany. The airline also plans to extend the route to London.

► **Pan American World Airways** will extend its South Pacific route from Sydney to Melbourne on Sept. 28 to coincide with introduction of Douglas DC-7C aircraft on the Australian service. Melbourne will have four arrivals and departures weekly. The DC-7C is replacing Boeing Stratocruiser, now in deepening loss. Pan Am, after making a landing stop at Canton Island of the DC-7C, will then fly to Sydney from Sydney to San Francisco and on from Sydney to London via the polar route, according to Pan Am's plan.

► **United Air Lines** reports its best company records for July by registering 497,146,000 revenue passenger miles a gain of 1% and 12,593,000 revenue surplus miles, a gain of 5%.



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3. Anti-jumping and stops
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This rugged screw jack designed for Fairchild by EEMCO, has an unusually long stroke (20 1/2 inches) fully self contained, with the compact electric motor driven ball bearing mechanism at the bottom end, it is 20 1/4" long when extended, 20 1/4" when retracted, 20 1/4" in diameter like female nut, yet is only 12 lbs. 6 oz. in weight! Operating load is 3300 lbs. EEMCO Type 3-1000 linear actuator's motor, geometry reduction gear, clutch and brake, adjustable end limit switches, and non-jumping end stops are all enclosed within the female nut. Motor shaft off automatically when the load limit is exceeded, and when end stops are reached.

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Satellite Controls Pose Major Problems

By Robert L. Sweeney

San Diego—Three problem areas in satellite attitude control were outlined during a recent space symposium meeting here. In Robert E. Robinson of North American Aviation's Astronautics Division.

Series of meeting, generally available literature on satellite attitude control indicated several areas ripe for thorough investigation in this field, according to Robinson.

Meeting, sponsored by the Air Research and Development Command, American Rocket Society, and Institute of Aeronautical Sciences, had technical sessions, a panel on its working and aspect of space exploration and a human factors session.

Three Major Areas

Intending the subject, Robinson outlined three major areas contributing to the present problems of the attitude control problems.

The first area he defined as a set of "foundation problems," the second a quantitative description of attitude motion, i.e., formulation of basic equations of motion, and the third the performance requirements.

Just as the foundation problems Robinson said, is whether the extra vehicle is to be controlled in such a certain number of its moving parts.

Although the answer will depend largely on mission requirements, some control over the entire vehicle is required and has been treated extensively. The condition of stabilizing several parts has not been treated in yet.

Second foundation problem is an attitude reference system, with several papers mentioned which have dealt with a satellite with one axis to be kept pointed down toward a surface planet and the direction of the acceleration and the satellite's fixed acceleration provided by a spin stabilization. Robinson also mentioned a paper on a laser reference system for spacecraft in direct line-of-sight communication with ground stations in the solar system which could be a future for a natural attitude reference system.

Completing the foundation problem, Robinson said is the choice of a set of reference axes in the vehicle and definition of suitable deviation angles between vehicle axes and attitude reference axis.

Robinson described the literature on control devices for attitude pointing out the possible interrelationship between physical sources of attitude perturbation which also are potential sources of control torque.

He also discussed various devices for attitude control, noting literature on

the several systems which can be used for this purpose.

The complete control system, Robinson pointed out, is the least of attitude control, including the control or actuator device, the attitude rate sensing device, and the control filter or computer.

Although a number of systems have been mentioned in the literature Robinson said, not many details have been presented on the motion or performance analysis.

Three areas which need especially detailed study, Robinson said, include development of new systems for control in addition to such as flywheels, gyros, reaction wheels and combinations of these.

Synthesis Problem

Second area is to consider more research and work since through the synthesis problem is a problem of some considerable design.

The third area is to analyze the existing system performance with special attention to the effect of unmodeled error.

A question not covered Robinson noted, is man's function in attitude control.

Another question not covered is, indeed, is the general area of design principles to use the attitude control problem as much as possible. Quoting

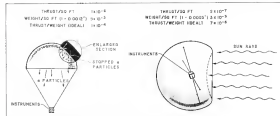


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NACA Space Vehicles Would Be Self-Propelled

National Advisory Committee for Aeronautics drawing shows a sub-orbital vehicle, left, and a photon jet, right—vehicles designed to propel themselves through space. Propulsion methods are feasible but do not require providing for reactants (space contains). Both vehicles would produce very low thrust per unit area as weight. An extremely large area would be needed to carry a useful payload.

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from one paper, he said that "from the point of view of critical control, a satellite or spare vehicle is not a structure, but a previous autonomous."

Space Communications

Use of balloons with antennas pointed to them, which are inflated in space, was proposed in a paper by Maurice Chelton of Convair Aerospace Division.

Giving that the regular concept on lead to design of broadband antennas, a spherical spiral antenna can follow this concept, Chelton said. A design factor is proper relationship of circumference of the sphere and wave length.

Space communications have several problems of their own which such an antenna would help to alleviate, he indicated, such as the attitude between transmitter and receiver being constantly changing, providing accurate knowledge of the polarization. Another problem is Doppler shift, especially in lower orbits.

Space antennas must radiate heat as well as radio frequency signals, Chelton said, indicating the proposed configuration should help in this area as well as those that present antenna shape and construction.

Additionally, he said, spherical antennas should serve radio signals with nearly all polarizations and within a very wide band of frequencies.

Another possibility for low frequency is the release of ionized gases following the spacecraft which results from gas ionization colliding with the drag at high velocities.

These gases could very well be excited by probe or loop antennas, Chelton said.

Propulsion Systems

Three basic propulsion systems for type space vehicles were listed by Dr. Milton U. Clauser of Space Technology Laboratories of Ramo-Wooldridge Corp., along with three types of particle accelerators.

Basic propulsion systems he listed as solar, using plasmas energy, nuclear fusion, which requires a heat transfer system and nuclear fusion, by which energy from the reaction can be much more efficiently used.

Research indicates that thermocouples after it must pass through when nature to control the reaction are developed, Dr. Clauser said.

Three types of particle accelerators he outlined are electrostatic, where magnetic fields in axial and direct, where a heat transfer by convection, induction or radiation is applied directly to the working fluid.

Optimization requires proper matching of these two elements, Dr. Clauser said, with the reaction time and direct

acceleration being among the best parameters considered.

In a paper on power systems for autonomous systems by A. L. Heister and R. H. Bollen of Rocketdyne Division of North American Aviation, nuclear energy and solar energy were mentioned for their potential, and as an area of problems (issue considered).

Acknowledging the limitations of solar power, the paper noted that one consideration was on a nuclear generation system. In this, the system for the thermal conversion of the nuclear reactor's heat to energy was studied in Rocketdyne using helium gas and a Rankine cycle using organic and alkali metals, with alkali metals showing better than success.

Use of the Rankine cycle permits lower turbine inlet temperatures and requires less pressure, less isolation and to dissipate heat built up in the cycle.

Considerations had a sodium cooled reactor and heat exchanger functioning to effect transfer of thermal energy from the reactor to the power via thermionic cells. Possibilities of cooling the reactor with the working fluid also was studied, but properties which make a good working fluid are not actually always the desirable ones for coolant and vice versa.

Auriferous noted that good hardware is needed for the conversion among the stream being a permanent magnet motor or group of motor capable of making for extended periods in space and taking less requirements.

Possibility was discussed of using an electrostatic generator of the type producing voltage from a change of capacitance of a variable condenser, which operates in a vacuum, has a high efficiency and generates a high voltage.

Paper noted that this generator could be cooled like other parts of a space craft, and might have a closed cycle air heat or refrigeration system.

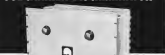
Materials Studies

Five elements of materials, commonly called "ultrafats" have discussed the highest strengths known in some materials, approaching the theoretical limit of atomic cohesion according to a paper by George A. Hallman of Ramo Corp.

His paper investigated possibilities of putting this strength to work in structures, and with structural characteristics of hypothetical materials composed from whiskers, a composite with weights of atomic structures from crystalline materials can make. Weight reduction to one-fifth present values were seen as possible.

Strength increases with decreasing crystal dimensions began to change sharply as whisker size were reduced below one ten-thousandths of an inch,

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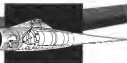
Capable of speeds in excess of 618 mph, Convair's "880" jet transport incorporates many of the newest concepts in applying modern weight-saving materials.

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Where titanium is used, engine parts are stronger, longer life, more reliable. Demand that titanium engine and turbine parts meet the most exacting standards for safety and reliability.



Hoffman and, and with in the past three years have shown strength levels have been tested at levels near those of titanium. The effect has been noted in size, cost and many details, which is not comparable to steel, bronze, copper, nickel, and many others in that size and platelets of many materials.

Strength Properties

Thermally expanding the strength is due to low incidence of edge dislocations, the reducing force on central surfaces. Stronger whiskers contain only some dislocations, along their ends, and almost no edge dislocations. Growth mechanism of a whisker tip has been explained by dislocation theory, or assumption of a spalling growth around a single screw dislocation, a fracture growth by order nucleation on the steps along a screw dislocation which almost eliminates the weakening edge dislocations.

Other reliable properties of whiskers have been observed or inferred from exposed structure of edge dislocations including reduction by whiskers of a plate, using whole and compound microscope only, that stress up to high failure, creep has not been observed in whiskers below several megapascals per temperature, applying considerable strength retention at elevated temperatures under all conditions of a whisker may differ slightly from whiskers of large polycrystalline amounts of steel material, and can range from a factor of 10 to 100 of polycrystalline materials.

Continuous density over whiskers tensile strength ratio of conventional material structures is supported by density over modulus of whiskers with the whisker along center. Impurities to date, however, indicate that the most promising room temperature whisker materials are the two passed boron carbide and the metal borides.

Reduction Factors

With certain assumptions Hoffman calculated standard properties of a boron-bonded whisker material and compared these with those of titanium. While first results indicated high weight reduction, Hoffman pointed out that certain reduction effects could yield a more realistic reduction factor. Comparison, he said, should include factors peculiar to material under consideration, such as use of ductility, fatigue problems, and bearing with a very serious problem with whisker-based material.

Including design factors which lead to a more realistic basis for comparison, Hoffman still concluded that weight reduction of the order of 50-60% of these of present day materials could

be obtained in such elements as cables, heavily stressed sheets fastened to a base by reasonable, largely stress and pressure-resistant fasteners, sheets can provide an excellent application.

Many products of whiskers can be effected in chemical reactions of metal bodies, electrolytic deposition, vapor deposition, high stress, solvent resistance elements, in order to produce whiskers of needed quality, quantity and form. Collection can be accomplished by whiskers in mechanical coupling and alignment, fracture and length could be controlled by proper production methods.

Handled whiskers could be spun into fine strands like twines, the strands woven into fabric or sheets. Impregnation with a binder or pressing and heating could establish the first good sheet bend between adjacent fibers to attach whisker strength such as a composite sheet with glass fibers.

Human Factors

While pathological changes in animals have occurred in subjects exposed to radiation at high altitudes in balloons such as a gray skin appearing on nose, there is no such evidence in humans exposed with exposure to low gamma cosmic radiation in exposures up to 24 hr, according to a paper prepared by Lt. Col. David C. Semons and



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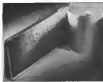


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detailed information about Solar's systems capabilities, or about any of the areas mentioned above, write to Dept. F-60, Solar Aircraft Company, San Diego 12, California.



MISSILE ENGINEERING

How Submarine Fires Regulus II

Regulus II guided missile port-loading deck on board the submarine USS Greenback at Navy Island Naval Station, Vicksburg, Calif. Submarine is fitted with special forward deck hangers which house the missile. In the pre-launch mode, stored on it dockable Regulus II was craned from one of the two forward missile launchers. When clear of launcher tubes, the Regulus II was hoisted and nose cones were unshipped and secured in flight position. In flight configuration, the missile's General Electric JT9 turbine engine was started and run to period power. Crew training exercises are in the past when the sub's rocket boosters would have been fired to actually launch the vehicle. Although photo shows a cluster of ones on Grayback deck, the firing is largely an automatic procedure handled from a control room inside the submarine. Regulus II comes out of deck launchers in special manner it is stored in the sub and then fired from the deck (AF June 21, p. 61). Chance Vought Aircraft missile utilizes an Aerojet General rocket motor JT9 engine (this produces about 13,000 lb. thrust).



Hoisted deck (right) are stored in reserve state, missile from port launcher (below).



Nose cones, wings are folded (left) and in flight position (right). Missile's JT9 engine is run-up (below), ending exercise.



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Australian Malkara Missile Nears Tests

London—About 10 Australian Malkara anti-aircraft guided missiles will be fired in tests on a missile range on the Solom coast of Scotland next month. Lt. Col. H. S. King of the Research Development Establishment, Kew, Surrey, said it is unlikely that Malkaras will be fired with explosive warheads for tests. Missiles in a 200 lb. ground-to-ground subsonic controlled weapon (AW August 15, p. 37).

Bristol has ordered 160 Malkaras from Australia. Evidence of the weapon was disclosed by Arthur Jones, Minister of Supply, during a visit to Melbourne. The contract price details of a contract worth \$4,160,000 for 160 Malkaras and 50 Javelin target aircraft.

Malkara was developed by Australia at Commonwealth Aircraft Factory, Melbourne. It can be used against tanks, pill boxes, landing craft and small ships. It is launched from a mobile platform.

Canadair to Produce Sparrow II Missile

Ottawa—Canadian government will spend \$14 million this year on production of the Douglas Sparrow II air-to-air guided missile.

Canadair Ltd. is producing the Sparrow II for use on the Avro Arrow C-105 jet fighter. Company previously awarded an \$8 million preproduction planning and engineering contract for the missile. Tooling costs will amount to about \$2.5 million.

In other Royal Canadian Air Force contracts, a total of \$159 million will be spent for production of 25 Canadair CL-55 Argus anti-submarine warfare aircraft. Price includes engineering and development costs.

Canadair also has received a \$24 million contract for production of eight CL-44 transport aircraft. Aircraft is a derivative of the Beechcraft Bonanza aircraft. The company also has received \$5 million for CL-44 engineering work, plus \$10.3 million for tooling costs.

PRODUCTION BRIEFING

Westinghouse Electric Corp., Los Angeles, Calif., will build electrical equipment for power distribution system for the Thor missile under \$1,799,000 contract. System, including buswork, positioned outside, is equipped to roll back the length of the missile prior to erecting and firing.

Ailkenbach Division of Genet Corp., Phoenix, Ariz., will do a top component in stock on the Altair IBM order \$1 million contract.

AVIATION WEEK, August 25, 1959

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Now, Tapco's capabilities have been broadened to include most phases of nuclear-power plants and accessories. Research is under way on the special metallurgical problems associated with radiation effect.

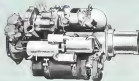
Fuels for all types of engines and power plants are collateral research projects at Tapco, where complete facilities for research and evaluation on solid-state, liquid and nuclear fuels are in existence.

Function testing of nuclear reactor control rod drive mechanisms ► in a simulated vessel head, part of Tapco's combining research project on nuclear reactor components and control systems.



► Special problems of forming, heat-treating, and resistance welding were solved at Tapco in producing this large weld metal for jet engines.

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At left: Combustion turbine and afterburner engine drives fuel pump now providing thousands of hours of trouble-free service in production fighter aircraft.

At right: Rocket engine turbo pump now in production at Tapco for use in several of America's leading missiles.



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Submerged Tube Launches Polaris In Navy Tests

Technique for launching the Lockheed Polaris fast ballistic missile from underwater is being tested near San Clemente Island off southern California by the U. S. Naval Ordnance Test Station (AW April 21, p. 31). An inert Polaris missile is hoisted into a launching tube which is pulled down to a launching pad on the ocean floor by winches operated from shore. The underwater launching tests are scheduled in detail for soon and several instrumentation personnel bestride the ocean surface, and connected to a sensitive barge in the test area.



Sea diver works on set at Polaris underwater launching test site. Nets are dropped to catch inert Polaris missile as it falls back to ocean after being launched.



Navy's Lockheed Polaris fast ballistic missile is lowered into a launching tube which will be hoisted to San Clemente Island on barges of the U. S. Naval Ordnance Test Station where underwater launching tests will be made.



Inert Polaris missile rises from ocean's surface after being launched from underwater tube at San Clemente Island test area.





COMPUTER PROGRESS

Digital and Analog Computers at Work

ARTICLE 3 VOLUME 1

NEW ELECTRONIC HEAT RATE COMPUTER HELPS SLICE THROUGH AIRCRAFT "HEAT WALL"

The latest General Electric Computer helps simulate aerodynamic heating encountered in flight by high speed aircraft. Compression of air around an air frame increases its temperature. The temperatures can be calculated from wind tunnel test data taken from scale models. Stresses created by aerobically heating external surfaces surface in a high temperature test laboratory aircraft designed to aid in structure design. The Heat Rate Computer not only indicates the amount of electrical energy required by banks of infrared lamps or other heat sources, but also controls the energy flow.

Calculation of the heat flow necessary for accurate simulation can be made by analyzing the thermal characteristics equation:

$$Q = hA [t(T_{\infty} - T_s) - BT_s^4]$$

where: Q —heat rate (BTU/hr)
 h —mass flow (lb./ft.²)
 A —area (sq. ft.)
 t —heat transfer coefficient (BTU/hr. ft.²)
 T_{∞} —free stream temperature (°F)
 T_s —surface temperature of structure (°F)
 B —radiation factor (BTU/hr. sq. ft. ft.⁴)



The Heat Rate Computer solves this equation instantaneously using both digital and analog techniques, then sends energy to the heat source of the proper heat rate. Q —Transistors mounted on the surface provide the feedback signal proportional to T_s .

One large computing system has been designed by General Electric to solve

late and control the heat flow to 99 airfoil areas. The unique use of a magnetic drum to digitally store T_{∞} and correct various function from drift and points keep storage of, and rapid access to curve data. Multiplying and time-sharing measures the amount of electronic circuitry.

COMPUTER DEPARTMENT LAUNCHES OPERATION OUTFURN WITH NEW MILLION DOLLAR PLANT IN PHOENIX, ARIZONA



General Motors H. B. Coldfield, Jr., is pictured at the controls of the Operation Outfurn, a new system which recently began to operate at the new 154,000 square foot plant which is expected to be completed by December of 1968.

"Our business is good and getting better," Coldfield said. "We're going to continue to expand during the year, either perhaps a hundred or more people." The department now has over 400 employees. The 160 cars which are loaded in them Valley Park, on the west of the Black Canyon Highway and south of the intersection with Thunderbird Road.

COMPUTING SERVICES GROUP HANDLES COMPLEX ORIGIN-DESTINATION STUDY FOR WESTERN CITY

The Computing Services Group of the G.E. Computer Department recently completed an origin-destination study for the Phoenix-Mesa/Scottsdale Traffic Study Group in Phoenix, Arizona. The results of this tabulation, when analyzed, will enable the group to plan the street and highway development program of the future metropolis for years to come.

The original major information was obtained by the city-office personnel using the following procedure: set up by the U. S. Bureau of Public Roads. The data was put on punched cards and then typed over to G.E. for processing and tabulation.

Using manual, or simple computing methods, such tabulations often take many months—sometimes years—to complete. However, using the Computing Services Group Computer as a main unit, the job was completed in just a few weeks. The Computer Department also performed the difficult programming job.

(Programming, simply stated, is the

translation of the solution method into the language a computer can understand, and the issuance of instructions to the computer so that it will process the information in a set.)

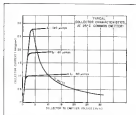
The Computing Services Group of G.E.'s Computer Department is staffed with 115 analysts, programmers, coders and leaders in the computer field. Their services are available, along with data on the input and transfer type 734 computer, to handle the problems of industry, business, government and education.

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COMPOSITE TRANSISTOR, used semiconductor amplifier (GTO), provides current gain of 15,000 to 30,000 with built-in temperature compensation. The device has 18 pins compared with two of the conventional transistor. Typical performance curve is at right.

Composite-Transistor Offers High Gain

By Philip J. Klein

Knoxington, Md.—Composite transistor, used semiconductor device which exhibits the high input impedance of a small-signal transistor, the low output impedance of a power transistor and the overall current gain (15,000 to 30,000) of a cascaded amplifier, has been developed by Advanced Research Associates, Inc.

Composite transistor is available in common EBF and NPN types, as well as in two types of PNP and NPN can configurations not found in modern transistors. The device also has built-in compensation which reportedly enables it to operate at higher temperatures.

New device consists of three junction transistors connected in cascade, plus several diodes and/or transistors added for temperature stabilization. Whereas a conventional junction transistor has two junctions, the composite transistor has total of seven. There are no resistors, capacitors or other non-semiconductor elements. Transistors and diodes are all obtained from a single epitaxial semiconductor

substrate, but an outside matched and compensated by Advanced Research Associates.

At present, collection of sources diodes is mounted and encapsulated inside a case measuring 2 x 2 x 1/2 in. There are three input-output terminals, corresponding to the collector, emitter and base leads of a single conventional transistor. When the designer applies a composite-transistor to a specific circuit or application, he can build the device as if it were a conventional transistor, except that his task is complicated by the built-in temperature compensation.

Is it a Transistor?

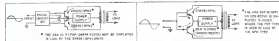
Some observers object to calling the Advanced Research Associates device a transistor, as it should more properly be called a transistor amplifier. In its present form, consisting of conventional transistors and diodes with leads of direct hookup, the device does in essence a small amplifier before it has been encapsulated and mounted.

But Norman K. Walker, Advanced Research Associates president, points

out that if the composite-transistor circuit were adopted in a semiconductor manufacture, the selection of junction could be fabricated rather than a single diode, possibly not much larger than present conventional units. If this were to happen, the device would then more closely resemble a conventional transistor than an amplifier.

Fact that the device employs more than two junctions of a conventional transistor is no reason for denying it the name of transistor, Walker points out. He cites, for example, the PNP and NPN bipolar semiconductor devices which have three junctions, and four junction units with two contacts, as cited in patents, all of which go by the name of transistor.

The company's case proved with much convincing that Electronics Division Asia has given official JREC transistor designation to T2M25 in ARAs first composite transistor which is now in pilot production. Walker emphasizes that ARAs has no claim to having conceived the idea of composite transistor, but believes it is the first



UNUSUAL PNP or NPN type composite-transistor with reverse polarity emitter-base current flow, when paired with encapsulated NPN or PNP type, makes it possible to eliminate phase inverter stage (left) in so-called push-pull amplifier, as shown in the circuit at right.

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Esophagus designed to cancel outside noise employs small esophageal (flame) device in side pocket which puts up indirect noise that leaks through in random. Flame at this point is screened and combined with incoming radio message in sound reproducing element (upper device) to effectively cancel out effect of external noise. Experimental esophagus was developed by Radio Corporation of America and Army Signal Research & Development Laboratory.

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... **minimizes**



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For the creation of today's most advanced missiles and the big space vehicles that are now in the planning stage, Martin capabilities are among the finest in the world. They are the result of a planned program of manpower and facilities development which commenced nearly fifteen years ago with the opening gates of the U.S. Missile Age.

MARTIN
BALTIMORE-DENVER-ORLANDO

transistors have been designed by ARA, but their design has not yet been frozen, which explains why the company has not yet obtained JEDEC designation for them. These units are:

- **ARA-25F**, PNP transistor, with cut-in current gain of about 15,000, input impedance of around 5,000 ohms, cutoff frequency of 7 kc/sec, also rated 7 amp.
- **ARA-25N-H**, **ARA-25P-H**. These are PNP and NPN transistors, respectively, with current gains of 15,000, input impedance of 2,000 ohms and cutoff frequency of 7 kc/sec, also rated for 10 watts maximum power dissipation, 5 watts maximum collector current.

Nature of the latter units is the fact that current flow between emitter and base is opposite that of conventional PNP and NPN units. This provides complementary units which can be combined with PNP and NPN transistors to give novel circuit designs.

For example, in an s.c. push-pull amplifier, a 2N625 (NPN) unit can be combined with the PNP unit, to provide the push-pull amplification and to eliminate the need for a separate phase inverter.

Advanced Research Associates also has developed a short-circuiting diode, type ARA-D1138, designed to protect transistorized equipment against over-voltage surges of d.c. line voltages above 25 volts. The device, measuring 2 x 14 x 15 in., contains a Zener diode in combination with a complementary diode. When connected across 25 v d.c. input terminals of a transistorized equipment, device serves as a shunt capable of absorbing up to 15 amp and dissipating voltage applied to the



Microwave Filter

New "half-wave" microwave filter unit waveguides, developed by Stanford Research Institute for Hewlett-Packard Co., Palo Alto, Calif., reportedly is easier to fabricate and occupies less space than previous waveguide filters. Unit shows less than 1 dB to 15.9 db attenuation (over) 100 MHz. Stanford design has been developed for 20.5 to 40 GHz.

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Consider the fact that Youngtown Airways exceeds 20,000 flight hours per year in its total fleet of 35 to 38 Beechcrafts, and the importance of spark plug reliability and performance is readily recognized. Today, 28 planes in this fleet are leased by 26 customers who demand optimum dispatch and arrival.

If you're a one-plane or multi-plane operator, profit from Youngtown Airways' experience — install AC Aircraft Spark Plugs! Get them from your AC Supplier.

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operation from exceeding 294 v, according to W3LW.

Advanced Research Associates currently is working on a composite transmitter which is expected to be able to control and transmit 200 amp or more from low-level signal applied to its terminals.

Price of ARA composite-transmitter runs between approximately \$112 and \$175, depending upon type and quantity ordered. The sheet regulating diode price ranges between \$87.50 and \$125. A number of companies have bought composite transmitters for radio stores, W3LW says.

Advanced Research Associates was

formed little more than a year ago by Walter, former engineer in the satellite guidance section at Britain's Royal Aircraft Establishment and Don Williams, company vice president. Prior to coming to the United States with Pratt-Schmitt Communications in 1955, Walter had developed a line of radio controls for drones. This was the first line of radars or which ARA tackled when it was formed.

The company has developed a number of miniature, high efficiency tubes and linear actuators as well as related transmitted radio controls. Customers include the National Advanced Commu-

The new composite-transmitter is an outgrowth of ARA's efforts to develop miniatured transmitter assemblies for use in its drone/modeled aircraft radio control system.

Company now has about 20 full time employees plus five outside consulting engineers on a part-time basis. It anticipates a major systems manufacturer in using composite transmitters for high-production defense equipment designs into the order, the company expects a major expansion.

Advanced Research Associates address: P.O. Box 55, Kensington, Md.

British Plan Four ATC Radar Points

London—Further details have been released on Britain's five-year plan to modernize its air traffic control system. The plan authorized by the Ministry of Transport and Civil Aviation, will cost about \$1.5 billion.

Beginning this year, the plan features new long range radar stations at four strategic points—southeast England, Manchester, the west coast, and near Perthshire, Scotland. At these stations electronic equipment will receive, store and display information required by the air controllers.

Feature of the plan due to increasing traffic and lack of airspace over Britain is the decision to reduce the amount of radar concentration between aircraft and ground. This results in an extension of the ATC ground radar coverage. The four new radar stations will have a low level range of 35 mi. and a high level range will cover 100 mi.

Radar information will be automatically sent to three joint civil-military ATC centers in London, central England and Scotland. In the central region the information will be displayed on plan position indicators but later displays will remove "clutter" and unneeded colors and show in addition individual aircraft altitude and height. An electronic store will automatically feed each individual controller with the pertinent information on his sector.

In parallel Ministry plans to install transponder-beacon control equipment for handling of triple plane identification by the air traffic controller prior to departure. The ultimate aim—complete mechanization of flight plan handling within the air traffic control organization.

Electronic radars has already been selected by the Ministry detailed proposals for the four new radar stations while the MTCA is in air traffic control experimental unit is studying the requirements of the second phase, the development of suitable information display system.



STRAIGHT TALK TO ENGINEERS

from Donald W. Douglas, Jr.

President, Douglas Aircraft Company

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Single copies of Edo Model 205 LORAN Technical Manual Edo, Dept. 670.

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Chance Vought Forms Avionics Department

Dallas-Chance Vought Aircraft Inc., has formed a new Electronics Engineering Department to manage avionics system group into the company's fighters and bombers and to do basic electronic research and development.

Electronics activity has been consolidated in one department under the direction of Dr. James F. Rogers, Chief Engineer Electronics Engineering Department.

The new group has about 100 employees, including 310 engineers, and Chance Vought says the department will be expanded in the near future to strengthen current capabilities and acquire new capabilities.

Formation of the new department reflects the growth in electronics activity at Chance Vought since 1951 when 30 employees were involved in the field.

Now the company manufactures about 55% of all the electronic equipment which goes into the Crusader aircraft and Regular models.

Electronic Engineering Department will manage current activity and available electronic systems, and it will participate in Chance Vought's share of the Boeing-Douglas project.

Earlier this year, Chance Vought moved into the field of commercial electronics when it founded the Genesis Corp. in Los Angeles, Calif. This subsidiary and aviation specialists in the design, development and production of advanced computer systems, components and related products, with the emphasis on commercial and industrial applications.

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TURBINE-POWERED S-62 can water taxi up to 15 kt, from 500 deg. in its own length. Aluminum hull compresses five compartments.

Aviation Week Pilot Report

Turbine Cuts Noise, Adds to Simplicity and

By Robert I. Stanfield

Bridgport, Conn.—Effectiveness of its new long front-top hull and lightweight gas turbine engine is reflected in the good water handling and flight characteristics of Sikorsky's amphibious S-62 helicopter.

Practically S-62—currently powered by YT35-G-6 engine—also evidenced adverse quarters and lack of vibration during flight evaluation by Avianco West, the first test report on a U. S. turbine helicopter.

Turbine-powered helicopter evaluates the dynamic parts of Sikorsky's S-55, including the main rotor head with the General Electric T55 or Raytheon T53 engine and a new fuselage.

S-62 is up to 998 lb lighter (weight) than the piston-driven S-55 (AW Jan 28, p. 96).

Torque-man engine is rated at 670 hp at the input to the main gearbox. That is based on the S-55's R-1360 engine output of 700 hp, less the difference between piston engine fan losses and gear losses in the new engine sec-

tion. Sikorsky is in the process of changing the YT35 fuel control unit so that full power of engine—1,035 hp—will be available, thus reducing power losses in fuel nozzles.

S-62 Performance

Evaluators pointed up three key features of the S-62A.

• **Controlability.** Helicopter is sensitive to light control forces, response was quick in all flight regimes. Main lateral control was similar to those of the S-55, there is no mechanical feedback.

• **Water Landing.** Autolandings were made over Long Island Sound from 3,000 ft. Wind was from the south at 10 kt, swell was about 2 ft. Waves outside were light to moderate.

There was no gradient in tide or day.

The S-62 was loaded into 600 deg. right turn, riding solid in water. • **Turbine power.** Both the T53 and T55 are capable of delivering the full transmission taking of 670 hp at an engine temperature up to 554°F. For standard conditions, the T53 is rated at 1,030 shp military and 930 shp normal conditions, the T55 is rated

960 shp military and 875 shp normal conditions.

While power in the production engine is presently limited in the basic engine, the B model of the S-61, which Sikorsky expects to fly next year will incorporate the S-55 rotor system and a new gearbox. Upgrading of the T53 engine is expected to produce up



THROTTLE quadrant and overhead panel are easily accessible to both pilots.



HELICOPTER'S hull is stressed to operate all water continuously. Three watertight compartments form stabilizing gyroscope.

Power in S-62

to 1,750 hp. Normal cruise speed is estimated at 125 kt., as compared with 90 kt. for the S-61A.

Prototype flown during evaluation was N380. Along with Avianco West pilot was Sikorsky engineering pilot Frank Yentel and two passengers. Basic weight of aircraft with instrumentation was 4,750 lb. With complement of four, plus 1,150 lb. of fuel (182 gal of JP-4) and 77 lb. of oil, helicopter's gross weight was about 6,700 lb. Maximum allowable gross weight is 7,500 lb.

Cabin was entered through a 5 ft. sliding member door on pilot's (right) side. Entrance was low, but it large enough for men to 12 passengers or six litter patients, plus four sitting patients and an attendant. Cabin measures 14 ft. long by 5 ft. 4 in. wide and is 6 ft. high.

Cockpit is roomy and comfortable, with large glass area that affords excellent forward and down views. Looking straight ahead, pilot gets 155 deg. upward visibility and 375 deg. downward visibility. Quartering side glance at horizon-line level gives further down view range, and there is an extra ceiling



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58
SEPT. 25-OCT. 3

pitch and increasing rotor speed—was tested.

Landing at an approach speed of 60 kt and descent at 1,500 fpm, was preceded by a levelled heading of the 5:30 at 125 kt. Engine was shut off after first landing, back to ground after a cooling down and check.

After-landing operation of the 5:62 was accomplished by adding automatic stabilization equipment developed by Sikorsky for the 5:55. Automatic stabilization equipment operates control system without moving pilot's levers, maintaining course, speed and altitude. To accommodate automatic stabilization, an additional servomechanism was installed in fore and aft control.

5:62 contains dual cyclic, collective and directional control systems. Primary hydraulic servos are installed on the main gear box for the main rotor control. Auxiliary lateral servos are installed on the aft face of the pilot's seat bulkhead. Primary servos are supplied by pump mounted on the main gear box. Auxiliary lateral servos are supplied by the main gear pump.

Both hydraulic systems are interconnected electrically so that, should the operating pressure in either system drop below the normal operating pressure, the other system cannot be switched off. If the helicopter is operating with one system off and a failure should occur in the left system, the "off" system will automatically come on. There is no auxiliary servos on the fore and aft and collective pitch control system. Primary servos control controls at floor 5:15 primary servos installed at the transverse axis. Hydraulic power is obtained by a variable delivery pump driven by the main rotor transmission.

Overriding pressure for this system is 1,600 psi with a relief valve setting at 1,200 psi. Hydraulic power for the auxiliary system is obtained by a separate variable delivery pump also driven by the main rotor gear box. Operating pressure for this unit is 1,500 psi with a relief valve setting of 1,700 psi.

5:62 control dimensions are as follows:

- Main Rotor—Disk area, 2,200 sq. ft., blade area (each), 12.5 sq. ft., solidity, 0.0119; airfoil, 001-1.
- Tail rotor—Disk area, 50 sq. ft., blade area (each), 1.88 sq. ft., solidity, 0.025; airfoil, 001-65 to 001-7.
- Stall—Area, 1 sq. ft., span, 65 in; chord, 17 in, aspect ratio, 3; airfoil, 001-5, angular momentum, plus or minus 14 deg.

Sikorsky built its own gearbox for the 5:62 at a weight of 60-70 lb. of weight. Main gearbox also is used as rear support for engine. Ratio is 9:1, 20,000 rpm for free turbine and 211 rpm for main rotor. The 20,000 free turbine rpm (free) counter is to main gearbox.

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THE LOS ANGELES HEADQUARTERS OF
NORTH AMERICAN AVIATION, INC.

to one-stage, high speed burnings; in addition, such company says its greater than standard spin rates. Free wheel unit enables Sikorsky to automatically disengage turbine from engine in event of engine failure, and make an auto retarding landing. Upper part of area gear box is a 5:55 self-shut down.

Helicopter, which can land 2,000 lb. of equipment, is geared to operate from land, water, bays, air bases and other bases. Design limits shall be wide range of utilization: emergency rescue, training and reconnaissance, rescue carrying, aerial servicing, fire fighting, transport and supply, and general utility (AW News 2, p. 24).

Price will run about \$21,000 \$220,000, depending on whether the customer wants the General Electric T55 or the lower priced Lycoming T53. Installation of the former adds \$17,100 to the aircraft's total cost. Land version of the 5:62, main rotor hub and spacers in fitted with conventional three-bladed fuel loading gear. Land version is lower, slightly faster, and carries 140 lb. more payload.

Second prototype 5:62, now being used for demonstration flights, was built by the Army or Navy for evaluation in which case the third model—not the end of the test—will be used for test work.

Program calls for complete completion of the aircraft before the end of 1959. By the third or fourth quarter of 1960 company will be available. Non-military military version can be delivered in 10 months following order.

Operating Costs

Operating cost for the 5:62 is estimated to be about \$100,000 less than the 5:55. The 5:55, which is now operating out of the latter, is estimated to be about \$100,000 less than the 5:55. The 5:55, which is now operating out of the latter, is estimated to be about \$100,000 less than the 5:55.

Chief source of military purchase of the 5:62 A-10 Sikorsky engineers, would be the need for only a few hundred new units rather than several thousand. Request immediate savings could be the savings of purchase of four composite materials in one aircraft, in quantities to cost 240 lb. in total weight. The 5:62 would reduce 570-780 lb. combined components with various kind of rotating components in 5,000-5,000 lb. weight. Weight will be 100 lb.

Engine components of the 5:55, used in the 5:62, include main rotor blades, tail rotor blades, main rotor hub, tail rotor hub, main gear box with new power input section into main gear box, and gear box, drive, flight controls (main rotor) including servos and 5:55 main gear box, gear box of hydraulic section and tail rotor pilot.

ENGINEER OPPORTUNITIES AT RAYTHEON



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For complete details on engineering positions in any of Maynard's project groups, please write John A. Oliver, P.O. Box 177 A, Raytheon Maynard Laboratory, Maynard, Mass.

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TRAINING: student pilots and business flying are fields for which new two-seat Model 150 has been designed.

Cessna Re-Enters Two-Seater Market

Wichita, Kan.—Introduction of new side-by-side, four-place aircraft Model 150, in October, will provide Cessna Aircraft Co. with the broadest product representation in the business flying industry, comprising a total of seven different types.

Model 150 is the first two-place aircraft built by the Wichita, Kan., company since the Model 140 was discontinued in 1950 and a subsequent gap in its business flying line resulted in heavy emphasis on four-place private airplanes. Now airplane is an attempt to supply a growing demand for a modern all-weather two-seater.

Company reports that it already has firm orders on its books for 600 Model 150s from its distributor organizations, in addition to another 115 being allocated for export. Its total estimates the entire number of airplanes it had contracted for its initial production run.

Cessna expects high sales volume and heavy production life for its new airplane. To broaden its sales potential, the Model 150 will be available in three versions.

• Standard, priced at \$6,995, which includes a standard equipment a steel three-piece Semach perfect stories 20-hp generator recording tach-

ometer, standard altimeter, navigation lights, engine oil pressure, oil temperature and electric fuel pump, indicator heater, stall warning indicator, air speed indicator, parking brake, brake for ground brakes (on pilot's side only) and standard instrument panel.

• Deluxe, priced at \$7,940, having a Norton Supercharger with main crystals (Rosen on export models), microphone and radio speaker, turn-and-bank indicator, rate of climb, engine oil temperature, gages, dual controls, landing lights, standard altimeter, clock, radio, vision control lock and cigarette lighter.

• Intermediate, estimated at \$6,145, includes dual main and horizon gyros with engine driven vacuum system and its associated rotating lenses. This model also has all of the trainer's standard equipment except the dual controls.

Available in the future will be a special "pilot" wing with additional fuel capacity, for type test, payload or other specialized long-range missions.

Model 150 is powered by a new 100-hp Continental O290-A engine, producing a top speed of 124 mph at sea level and maximum recommended cruise speed of 121 mph at 7,000 ft. Range at maximum cruise is 570 mi or 6.5 hr. At economy cruise using 45% power at 10,000 ft., the Model 150 will have a range of 610 mi or 6.6 hr at two stages of 65 mph.

Fuel capacity is 26 gal., with 22.5 gal. comprising the slatted auxiliary fuel.

Plane is designed for a 740-hp rate of climb and service ceiling of 15,100 ft. Gross weight is 3,390 lb., empty weight is 962 lb. Dimensions include

wingspan, 35 ft. 6 in., length, 21 ft., height, 6 ft. 11 in., wing area, 160 sq ft. Wing loading is 9.4 lb./sq. ft. and power loading is calculated at 13 lb./hp. Maximum operating wing flap load is an area of 17.19 sq ft.

The Continental O290-A engine net its 100 hp at 2,750 rpm. Recommended maximum turn time has been set initially at 600 hr. Its basic dry weight is 109.6 lb., 220 lb. including accessories. Displacement is 200.91 cu in. with a 7.0 compression ratio. Fuel requirement is 58.57 cc/hp.

Landing gear is more robust than steel spring type used on previous Cessna. Trend between main gears is 77 in. and is designed to provide good

ground handling characteristics in sandy weather. Gear is fitted with new Cessna ground-tire breakers having machined grooves and teeth around the perimeter of the wheel disks and inside the wheel castings, replacing levers and clips previously used to hold the disks in place. These are furnished with rubber tireless tires, all 4.80 x 6.

Top and bottom of the seat is adjustable forward and back, top of the seat folds forward to provide access to 52 ft. capacity baggage compartment. Above the baggage compartment is a utility shelf which can be replaced by a children's seat, capable of holding two, which will be available as late from the factory as optional.

Cessna Readies 210 For Late 1959 Sale

New, single-engine Model 210 business plane "of advanced design" is being flight tested by Cessna Aircraft Co. and will be available to purchasers as late as 1959.

Configuration and performance details are being kept a tight secret. Commercial Aircraft Division Vice President General Manager Dale Ruckus will only state that the Model 210 will give the company an entry in the high performance single-engine market (as rated by Stallion) (top speed 165 mph) and the 190 (172 mph).



MODEL shows configuration of turbine turbine helicopter Doman is designing. Maximum speed would be 150 mph.

Doman Designs Turbine Helicopter

Danbury, Conn.—Preliminary engineering has been completed by Doman Helicopters, Inc., here, on a new two-seater turbine-powered helicopter designed for a top speed of 160 mph. Company estimates that in production quantities, its new Model D-12 will sell for approximately \$12,000.

Project is being on a design study made by Doman for the Army Personnel planned for the D-12 is the new 250-hp Allison 250-C1 turbine, which was winner of a recent Army competition (AW July 21, p. 26). Engine

weighs under 100 lb. Fuel consumption is approximately 7.5 gal./hr. engine, the proposed D-12 would cruise at 140 mph and have a rate of climb of 2,400 fpm, Doman reports. Vertical rate of climb is estimated at 1,000 fpm, hovering, climbing in ground effect at 15,000 ft., hovering, climbing out of ground effect at 15,000 ft. and service ceiling at 25,000 ft. Range is calculated at 100 mi. and endurance at 2.5 hr.

Doman D-12 is designed for a gross weight of 1,650 lb. Overall length is

33.1 ft., tail height 7.7 ft., fuselage width 4.8 ft. and landing gear height 7.5 ft.

Main rotor would have a maximum diameter of 75.5 ft., can be turned according to the helicopter's applications. Bladeless version would be quite a smaller rotor, Doman states. Tail rotor diameter is calculated at 5.5 ft.

Design is planned for quick construction and maintenance accessibility, the company reports, with all components of transmission, gearboxes and rotor shafts arranged so that they can be serviced or replaced without disturbing other elements.



INSTRUMENT panel shows equipment on luxury model, except for dual controls.

NEW AVIATION PRODUCTS

Polaroid Aerial Camera

Polaroid's aerial camera, developed for aerial reconnaissance photography, is said to have applications in a wide variety of photography, as well.

Model 110 has a 10 in. focal length 1/16 f. aperture, lightweight lens and was light exposure. Polaroid roll film. Camera develops 1 in. x 4 in. contact prints, takes 100 sec. the only other. Shutter speeds are 1/325, 1/250 and 1/100 sec. Aluminum camera, weighs

8 lb., is designed to be held in the hand.

Most Development Co., Inc., 2143 E. 12th St., Des Moines, Iowa.

Self-Cleaning Fuel Strainers

Fuel strainer unit distills excess fuel as a means of filtering contaminants out of aviation turbine fuels. Jet strainer is used in the petroleum industry for filtering solids out of water and petro-chemical products.

Distillate excess fuel is added to jet fuel to be filtered. Powder forms an open, porous cake which is fine enough to trap contaminants but porous enough to let the filtered fuel pass through. Strainer drains off through a system of revolving jets which scour the screen and flush out solids.

Thomhill-Cover Co., P.O. Box 1184, Houston, Tex.

Ground Support Compressor

Portable air compressor for ground support of aircraft and missile systems is said to meet all pneumatic needs except that of fuel air starter system. Compressor is available in both electric and gasoline engine powered models. Model 15MR3500 (shown) is the electric unit. 6 kwh operates at 200



volts, 600 cfm, 1 phase output. This model delivers 2 cfm at 70 to 90 psi, 3,000 psi. Weight is 60 lb. Model 14MR1400, weighing 130 lb., is operated by a 25 hp single cylinder 4 inch gasoline engine. Gasoline powered compressor delivers 2 to 4 cfm at 70 to 3,000 psi.

The Comco Co., 500 34th Ave. N.E., Minneapolis 21, Minn.

Missile Pneumatic Regulator

Two-stage pneumatic regulator is designed for pressurization of submersible or buoyancy on missiles. Multi-purport design is said to provide close regulation of output pressure over a wide range of inlet pressures.

Regulator is said to maintain an adjustable outlet pressure of between 50 and 160 psi with a ± 2 psi at inlet pressures ranging between 3,000



and 300 psi. Flow rate under these conditions are 8 to 20 acfm of air or nitrogen. Regulator weighs 1.5 lb.

Wallace G. Leonard, Inc., 371 S. First Ohio Ave., Pasadena, Calif.

Emergency Hydraulic Valve

Reversing, acting, panel mounted main valve for up to 250 psi, pressure hydraulic or vacuum service is designed for emergency control applications, where first push-button action is desired.



Reversing action is supported by a stretched spring return and return, mounted on a two, three or four mounted valve body in sizes from 1/2 through 1 NPT. Valves are designed to 30 standard thickness control panels.

Valve Corp., 614 Morgan Ave., Akron 11, Ohio.



Jet Aircraft Tire

Aircraft tire, with durable tread design is said to be outperforming and outlast other jet tires. Photo shows 16-5.5 tire mounted on Corvus F-105.

Photo tread will be standard on the F-105, the first company states.

B. F. Goodrich Co., Akron, Ohio.

Oil Cooler Cleaner

System for cleaning aircraft oil cleaners is being, less expensive and more than present methods the maker states. Speed agent used is said to eliminate possibility of corrosion.

Oil cooler is put on tracks of a steam line steel cabinet and hose are attached to run solvent through the unit. Cleaning agent is then run through the cooler and cooler is then flushed with methanol/water.

Coe Inc. Chemical Co., Inc., 9120 E. Coe Blvd. Dr., Elmhurst, Calif.

High Pressure Cryogenic Pump

Stainless steel bottled gas pump, currently being installed at Edwards AFB produces pressures to 10,000 psi with flows to 10 gpm, the maker claims. It is used for tank mounted oxygen or nitrogen refrigerants.

Deane Research, Inc., a subsidiary of Air Products, Inc., Allentown, Pa.



booster stations or cascade systems.

Pump is five inches long and weighs 100 lb. in its portable configuration. Handling liquid oxygen, nitrogen or argon, pump is said to have industrial as well as military applications.

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For additional information, write:

Mark Elwood, Jet Engine Dept. AW-825
General Electric Co., Cincinnati 16, Ohio

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*Advanced missile and
space projects
require Engineers and
Scientists to work on*

THE FRONTIERS OF SPACE TECHNOLOGY

Lockheed Missile Systems Division, recently honored at the first National Missile Industry Conference as "the organization that contributed most in the past year to the development of the art of missiles and astronautics," holds such important, long-term projects as: the Navy Polaris IRBM, Earth Satellite, Army Kingfisher target missile, and the Air Force X-7 target test vehicle.

To carry out such complex projects, the frontiers of technology in all areas must be expanded. Responsible positions in our research and development laboratories and in our project organizations are available now for high-level engineers and scientists.

If you are experienced in physics, mathematics, chemistry or one of the engineering sciences, your inquiry is invited. Please write Research and Development Staff, Sunnyvale 2, California. (For the convenience of those living in the East and Midwest, offices are maintained at Suite 745, 465 Lexington Ave., New York 17, and at Suite 300, 840 N. Michigan Ave., Chicago 11.)

FLIGHT IN THREE MEDIUMS

Several things set the Polaris apart from other outer space weapons in the ballistic missile category, for the Polaris program involves a wholly new concept of weaponry.

1. It will be dispatched from beneath the surface of the sea.
2. It will be radically smaller than currently developed land-launched missiles, yet its payload will be as effective and its range the same as other IRBMs.
3. It will be the first operational outer space missile to employ solid fuel as a propellant.
4. It will travel through three mediums in a single flight—water, air, outer space.
5. Its launching base—a submarine—is not fixed but a mobile vehicle.

OUTER SPACE PROGRAM

Very little can be said about the Earth Satellite program at this time except that its success will accelerate advancing the state of the art in all sciences.

The Earth Satellite Project is perhaps the most sophisticated outer space program to reach the "hardware" stage in the U.S. today.

ENEMY SIMULATOR

The Kingfisher is the nation's fastest target missile, developed for the Air Force and currently being manufactured for the Army to test the accuracy of our newest supersonic weapons.

It is a target vehicle with Mach 2-plus capabilities. The Kingfisher not only has the speed to match the defensive missiles, but can also simulate a vast array of supersonic enemy missiles and airplanes attacking from great height. It is instrumented to score near misses and even theoretical hits without itself being destroyed.

It is recoverable from flight by parachute to be flown again, providing weapon system evaluation to be conducted at greatly reduced cost.

Lockheed
MISSILE SYSTEMS DIVISION

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Modernize Now — For Growth and Profits

The biggest challenge facing American industry today is that of thoroughly modernizing its plant and equipment. This is the test period for companies to prepare for success — or failure — in the '60s. Success depends decisively on one key policy — modernization, for growth and profits.



The problem of business recession is fading. Sales and industrial production are moving up again, slowly. Business is swinging back into its normal course. This is growth, not retreat and recession. If the recovery takes us back to the normal growth trend, industrial production will be up 15% to 20% by 1960.

But how can we get this growth in production without the plague of price inflation that has blighted our economy in recent years? And, of fateful consequence for the individual business firm, how can it keep its costs down enough to make a decent profit — something a very large share of American companies are not doing today?

This is the new challenge that confronts business as the recession is left behind.

Nature of the Challenge

The recent record on costs and productivity is not reassuring. Since 1957 wages in manufacturing have risen 68%, while output per man-hour has gone up 22%. This is a dismal record for a nation that has prided itself on

gains in industrial efficiency. Clearly, if we are to avoid continuing inflation, labor must key its wage demands more closely to productivity increases. But clearly, also, we must do far better in raising output per man-hour. Otherwise, industry cannot hope to offer stable prices, and still make a profit.

What, then, is the answer? It is modernization of plant and equipment, the replacement of obsolete producing facilities with new and more efficient machinery and buildings. Only in this way can industry hope to increase production, hold down costs and make a good profit showing in the years of growth that lie ahead.

Industry's Answer

The chart on the preceding page shows how American industry is buckling down to the task of modernizing its facilities over the next four years. It is planning to replace old equipment with new machines that will raise output per worker not just 2½ or 3% a year, but more like the 5% annual gain in productivity that this nation achieved in the years following World War I.

Since World War II we have had to contend with shortages of capacity and materials that have held back the job of raising productivity. But today the machines and techniques are available. And industry is getting set.

A broad sample of manufacturing companies surveyed by the McGraw-Hill Department of Economics earlier this year reported these plans: In 1958, expenditures for modernization will rise to 56% of total investment in new facilities — compared to 44% in 1957. And this emphasis will increase until by 1961, expenditures for replacement and modernization account for two-thirds of all capital spending by manufacturing companies. In dollar terms, manufacturers will spend more on modernization in each of the four years 1958-61 than in any previous year except 1957.

Can It Be Done?

These are big plans. Can they be carried out? Is it too visionary to hope that after a decade of expansion, industry can now find the outlets for large amounts of capital investment in the area of modernization? The answers are important to business and the nation, because on this new wave of modernization depends our hope of holding down costs and prices, and also the prosperity of the vital capital goods industries — generators of boom and bust in our economy.

To ensure that industry gets the answers, McGraw-Hill's 34 business publications are now starting a coordinated effort — the largest editorial effort in the history of our company — to find, report and publish the opportunities for modernization at a profit, in the fields we serve. These special reports will begin in late September and will run through November, with appropriate coverage for the specific needs of each field. We are proud to share with industry the responsibility for making sure that no opportunity is overlooked in the drive to modernize now for growth and profits.

This coverage was prepared by the McGraw-Hill Department of Economics as the first step in our company-wide effort to report on opportunities for modernization in industry. The Department is also preparing a longer report on modernization as a national problem, for publication in October.

Permission is freely extended to newspapers, groups or individuals to quote or reprint all parts of the present treat.

Donald C. McGraw
PRESIDENT

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LETTERS

Time and Language

Re Mei Mei Edwards' letter "Common Language" concerning Exponents (NH July 24, p. 128)

Since we (pinks, CNA, etc.), are over-coming London-Kingdom time—for some reason CNA wants to know what time it is in England on all our flight plans, operating points, etc.—I do hope that some responsible party doesn't get word of Mrs. Edwards' letters, or else we (pinks) will all have to leave Kansas or London to tell the tourists, etc., at that time to be the same that we are trying to operate now. In the event of an emergency, *etc.*, if the travel operators will just shake the stick, we will lead it all right.

For AMERICAN FRIENDS
San Antonio, Tex.
F. S. I want to know English and Central
Standard Time, and how and eggs, etc. I am
police agent, Cincinnati, etc. I am
CC(C); high school graduate; major in
athletics; an American language class.

High Hats

In reference to the letter from Mr. Ed Acosta (AW July 28, p. 94) concerning the article 'Indian Town Pressure in Forested Landings' (AW May 19, p. 80) and the letter from Lt. Mark Perazich (USN FID May Acosta (AW June 30, p. 86).

The three recruits were indeed fast together, but they were not Aimee Lightfoot. They were the horsemen of today's Blue Angels Naval Aviators' "High Hair," who trailed the action during the Boeing Twenties as they launched a legend for Right reasons. But will posterity be the 1920s Cleveland Air Race, now being unearthed the rest of Navy Boeing F2B's. One took off, landed, landed and landed while tail together by short lengths of one mile.

The Cleveland team consisted of Lt. R. E. Coffey (Rear Adm., USN), Lt. (jg) F. N. Korte (Rear Adm. NCND), and Lt. (jg) F. O. Berger (Rear Adm., Coast & Geod. Survey).

LT J. E. Hansen USMC
Lt Major Am Wing
MCSS 21 June 1964, Anch. Cold

Tethered Flying

I have been haunted by various stories carried at times about columnist *Christopher* who made the first Eisenhower landing. Not when the latter lands Mr. Bob Ayres appeared on July 28 issue (p. 94) in which he recalled some pictures of the 1952-1953a showing "three middle-aged Army fliers and 'dumb' boys taking to landing." I thought I'd set the record.

Perhaps Mr. Acosta did not sense pictures of "Ave" placed together, but I don't recall the incident during that period. However, I do know that VF 55, the fighter squadron attached to the old U.S. Lexington (sunk in the battle of the Coral Sea), did do this trick at the National Air Show held at Glenview, Ariz.

Definition: *Witch* selects the opinions of its readers on the issues raised in the magazine's editorial column. Address letters to the Editor, *Witch* 330 W. 43rd St., New York 36, N. Y. Try to keep letters under 300 words and give a genuine identification. We will not print anonymous letters, but most of ours will be withheld for reasons of space.

port, Chicago, in 1930. One airplane division was assigned to this job, with each wing man in each of the three sections having his inclined wing tied to his section leader's wing. (The squadron was there for five days, I believe, leaving for the West Coast the day after Labor Day.) Each day the division took off tied together.

The first two days they also loaded on the feed together formation, the rest of the time each worker is busy at the residence of that day at the field with the way were then breaking down is a pull up boards in.

The implants used were the P18-1 type which were later adopted by the Army Air Corps and designated the P12.

The landings were pretty tricky. The birds flying this way together were about 25 ft. long and it was almost necessary to keep them well tucked off. On the second one's landing one scissor leader crashed his landing post slightly and had to chop his shoulder faster than usual. As a consequence one of his wing was pinned but last month's without mishap. They

I know—I was one of the young men!
 Peter A. Winkler
 Canada USN Ret
 Huntington, N.Y.

Dimensional Dilemma

I have just read the letter by Mr. Hugh C. Robbins, president of Sabkhan American Co. in Los Angeles (VEB Jan. 31, p. 102). First of all, I am worried about a previous note; he was encouraging us, but statements "leave me cold." He comments that the "see and be seen" problem of search dogs is merely an extension of the same problem encountered in highway traffic. I would like to advance an opposing position with the same example.

The focus is of growing relevance to the highway as essentially a one-dimensional problem. Most of the time the driver and all passengers should, taking in to account even in very narrow set of vision, have a view as far down road driving on a large two dimensional area with no marked traffic lanes. This approach to the basic concept of navigation is not only more efficient, but also more effective. In the last few years, periods like at Kanchi ATO, in an other place, border lines, there are more vehicles spreading on the main and light bus, and the problem of keeping them in all directions for vehicles and moving among passengers constantly at panic, despite the fact that all traffic is at less than 35 mph. This, enough serious accident on wide open road, is not a problem. It is necessary to focus, better to avoid lanes, turning to the "one dimensional" order.

Now, when one leaves the ground in an airplane a third dimension is added and, as always, the relative closing speeds are increased 30 to 15 times. No one would be surprised, then, to assume the recognition problem exponentially. The simple mathematics of increasing the area to be observed at a given distance by the third power, and decreasing the time allowed for recognition to one-tenth of that experienced in highway travel, results in a very complex task.

Consideration of an traffic problem, however, is unnecessary, as study on solutions of highway traffic problems [said Mr. Robbins] shows that even a supposition of needed means can do this is not only mathematically absurd, but also dangerous.

2 Even the relatively simple problems of highway traffic control and accident prevention are, in the opinion of many, not of hand to parents. So much so that the problems of air traffic control, historically,

...of the same kind. The same kind of problem is that of having problems in one's interpretation of the same kind. Perhaps, part of the reason for this failure is that, when trying to solve the problems we still thinking in one dimension while we are looking at them.

1. Lt. ROBERT D. COLLINS, USAF
2. Maj. Sq. Sec. R12 Beach Wing
3. Trenchard AFB, Wash.

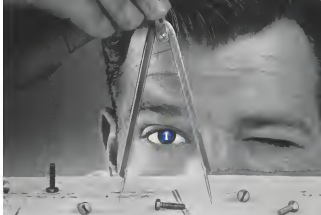
Bells in Oil Hunt

Our personnel have read your article on p. 37 of *American Water*, Aug. 4, entitled "Fungal 44 Acts In Old Sewers." The article

the account is fit as it goes. However, the major portion of what is occurring in the north end of Mississippi River's delta has been omitted. On the same job, in addition to the Venor #1 supplied by Indus, there are two Model 47G-5 powered by Thrall helicopters. In due report, we take note with some concern that the small field of helicopters have been used and found wanting. They have been used and found wanting. Admittedly, they cannot do the job of lifting the women, drilling rigs and the instrument track; at those same weights he uses 2,900 and 5,600 lb each. However, <http://www.usmbl.com> offers a somewhat different

For the study was a carefully conducted one that allows operators with only a "Vented 4A" the use of the unit to be able to shoot lines plus the "japs" and pull the "japs". In addition, they are advised to handle personnel between the various geographic regions that are being surveyed. No do not wish to distract as any one from the performance of India's Vented operator. It has been and continues to be a difficult job. We feel, however, that the 670 is operated by South Vietnamese would be an up there, but those of the type

R. G. Evans, Jr.
Vice President and Manager
Black Helicopters
P.O. Warth, Tex.



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